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Selection of Dental Materials—*Souder*
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Symposium on Foil—*Woodbury, Waters, Blackwell* and *Southwell*
Roentgen-Ray Burns—*Kells*
Ethical Phases of Practice—*Young*
Eventual Dental Curriculum—*Banzhaf*
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EDITORIALS
Some of the Reasons
What Books Shall the Professional Man Read?

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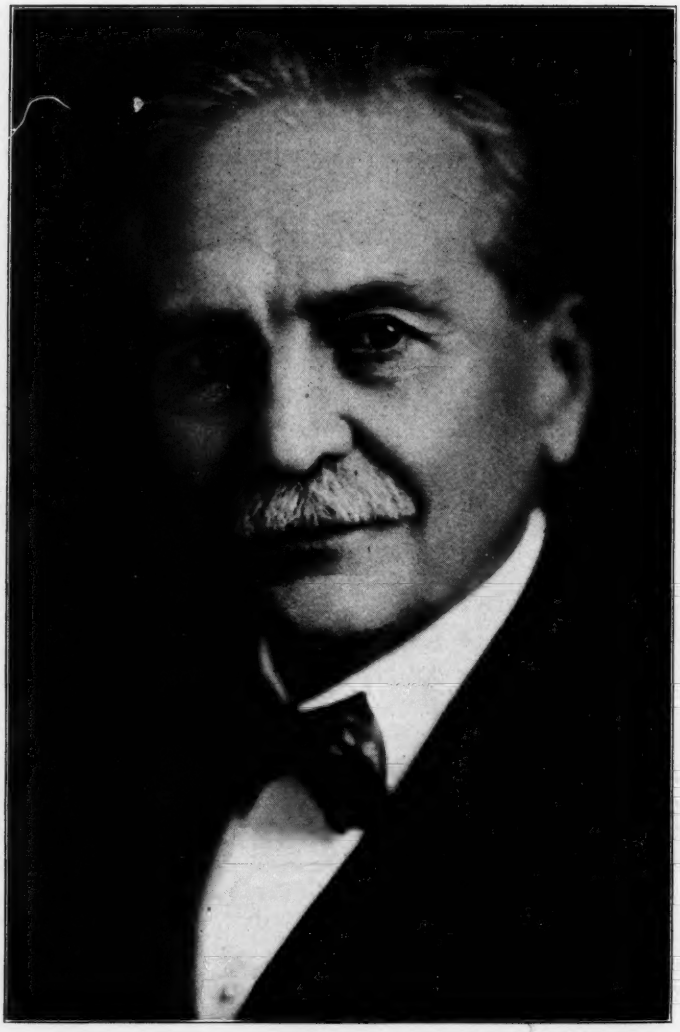

NELVILLE SOULE HOFF, D.D.S.
(1854-1926)
Dean of the University of Michigan, College of Dental Surgery, 1911-1916

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Original Communications

THE SELECTION OF DENTAL MATERIALS*

By WILMER SOUDER,† Washington, D. C.

YOU are aware of the cooperative research on dental materials[1] now in progress at the National Bureau of Standards and are doubtless familiar with the progress reports[2] that have been issued. It has been my duty and privilege to keep in closest contact with this work and to assume responsibility for the general accuracy and completeness of the program. It is from this experience that I am selecting material for the paper which is being presented today. Although this report is presented by a member of the National Bureau of Standards, fairness to the cooperating laboratory[3] and research associates demands this acknowledgment of their part in executing the details of the research program as outlined.[1]

While the active cooperation and financial support of the American Dental Association has not yet materialized, I am in no wise discouraged over the progress of the work, but am quite enthusiastic about the future prospects for the rationalization of methods, ma-

*Published by permission of the Director of the National Bureau of Standards of the U. S. Department of Commerce.

*Read before the Section on Physics, Chemistry and Metallurgy, Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

†Physicist, National Bureau of Standards.

1. Dental Research, J.A.D.A., 11:249 (March) 1924.

2. Souder, Wilmer: Physical Properties of Dental Materials, J.A.D.A., 12:509 (May) 1925. Coleman, R. L., Jr.: Ibid., p. 520; Dent. Cosmos, 68:743 (Aug.) 1926.

3. The Weinstein Research Laboratories, represented by the following research associates: R. L. Coleman, W. H. Swanger and W. A. Poppe.

terials and results in this branch of dental science. The increasing interest shown by leaders in the profession guarantees the fullest cooperation and a most effective reception of data at an early date.

THE INLAY

May I spend a few minutes in discussing the problems encountered in making the inlay, illustrating what definite data indicate for this operation? This selection seems to be appropriate if judged by the amount of attention given it since its introduction and especially during recent years. If there is another problem in dentistry concerning which one can read more and learn less, articulators excepted, I have failed to find it. The methods adopted in studying the inlay are as applicable to any other subject. The plan calls for the evaluation of each variable entering the manipulation and structure. Until other subjects are given the same type of study, we shall continue to have conflicting claims, damaging practices and failure to get most satisfactory results.

TABLE 1.—DIMENSIONAL CHANGES ACCOMPANYING INLAY TECHNIC.

Material	Temperature Interval	Length Increment Per Cent
Wax	28 to 40 C	+0.72
Investment	(setting)	+0.20
Investment	40 to 350 C	+0.31
	Total Increase	+1.23%
	Contraction of gold (to be compensated)	1.25%

You are experts on the properties of dentin. It would be presumptuous for me to attempt to explain its porous structure or its brittleness. Attempts to specify its hardness by Brinell tests were unsatisfactory, as the test ball sank or flowed continuously into the structure, despite the fact that scratch hardness indicated a hardness about the same as the scratch hardness of tin. You know that instruments much harder than tin are required to cut or, perhaps better expressed, to fracture dentin. Samples subjected to ultimate compression tests gave a value of 30,000 pounds to the square inch, with an uncertainty of not over 15 per cent. As the amount of compression before rupture was extremely small, the brittleness of the framelike structure was evident.

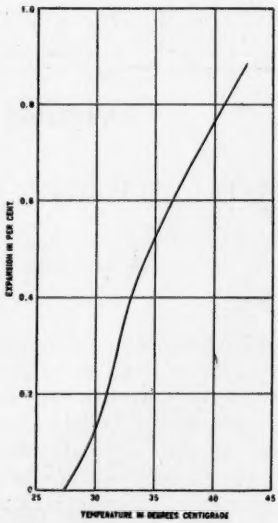

Fig. 1.—Thermal expansion of inlay wax (formula given in text).

FITTING OF RESTORATIONS

On a material such as dentin one may compress and permanently deform or break down the rigid frame over a very small area only or along a line and not fracture the tooth. One very small imperfection in a restoration might be ignored and the inlay forced to position with only local injury. For any considerable surface subjected to the force of such wedging action, the result will be a chipped or split tooth rather than compression of dentin. Restorations must fit, and this requires a procedure that will enable the operator to cast to dimensions. Anything less is a compromise and proves improper selection of technic or material. The problem is not solved until each element or process entering the cycle of operations is specified in its effects on the finished casting.

INLAY WAX

By selecting a wax that will maintain a fairly rigid texture up to 40 C., fitting this wax, cooling in position, adding small quantities where needed and securing a pattern that fits at 28 or 30 C., you will have a maximum of favorable conditions thus far. The wax should be invested at from 38 to 40 C. Table 1 shows the effect of this procedure. A wax that almost meets this requirement can be made by a combination of 25 per cent carnauba, 60 per cent paraffin (55 C., melting point) 10 per cent ceresin and 5 per cent refined beeswax. Oil soluble colors may

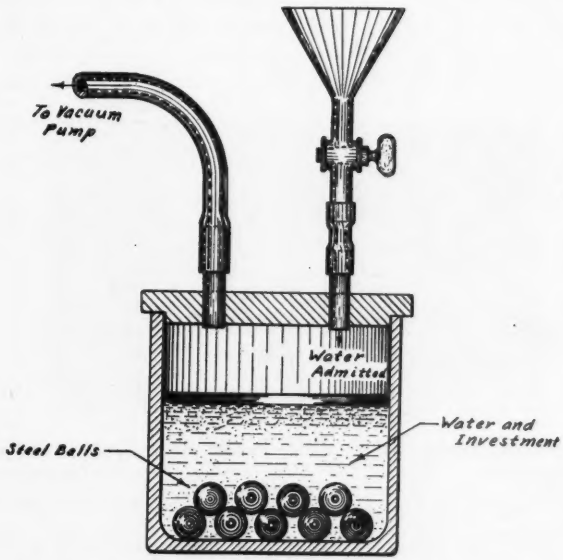

Fig. 2.—Vacuum mixing cup. While this arrangement is quite satisfactory for experimental work, one would not attempt to use it for an extended period of time without simplifications. The mixing is done by shaking the cup and contents.

be added if desired. This wax will work well in the mouth if properly warmed. If overwarmed, the granular consistency imparted by the carnauba will become too prominent. This may be eliminated and the working range extended by substituting small percentages of dammar or similar material. The formula given can be eliminated from the investment more completely and will be found more rigid than the modified wax. In fact, if there are undercuts, it will break before it will distort. This property of breaking before distorting should be one of the requirements for a satisfactory wax. Complete elimination is another. The large coefficient of expansion shown in Table 1 and Figure 1 is also important if we are to compensate for gold contraction by previous expansion of wax and investment. This seems to be a logical and successful procedure. I believe the idea was first announced by Dr. Van Horn, though he was seriously limited and handicapped in making exact application of the principle by lack of accurate data on the different elements entering the cycle.

INVESTMENT MIXES AND DEFECTS

The next item in which we are interested is the investment compound. This important item is usually ignored by essayists. We were unable to find in the literature a single value on strength and length changes over the ranges and at all temperatures used in dentistry. A few findings in addition to those announced previously will give decided assistance here. I am convinced that 90 per cent or more of the small bubbles in investment mixes and the consequent nodules appearing on castings are caused by air entrapped in mixing. The larger voids are usually caused by failure to apply the mix continuously over the wax pattern. We went to great trouble to determine the cause of the small bubbles. By evacuating the cup containing the dry powder, admitting the water and mixing in a vacuum, we secured air-free material, smooth surfaces and castings free from nodules. Figure 2 shows the details of

Fig. 3.—Investment surfaces. *V* shows the vacuum mix and *H* the hand mix. Observe the numerous small voids in the hand mix. The largest voids are defects in the application of the investment to the sheet of wax and should be ignored.

this development. It would be difficult to arrange a better method for entrapping air in a mix than by the vigorous practical tendencies will reduce the evacuation method to the convenience of the old bowl and spatula technic.

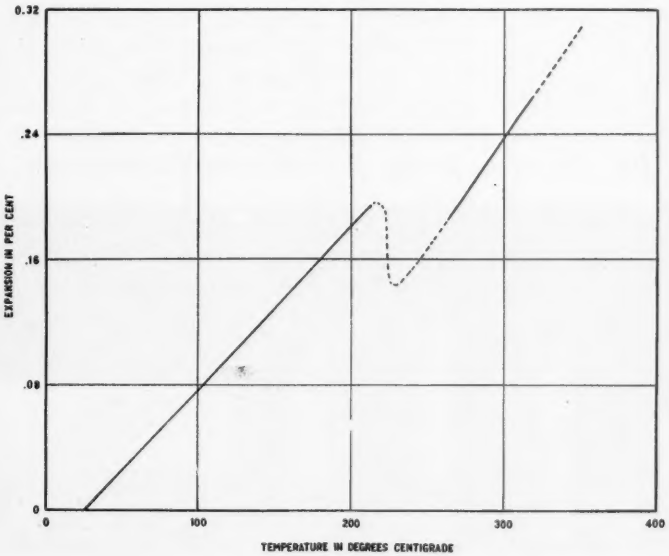

Fig. 4.—Thermal expansion of investment. The silica plaster ratio is, approximately, 70:30.

hand spatulation sometimes practiced by operators. Excellent comparisons are made in Figure 3. The use of the mechanical spatulator having a stiff blade approximates closely the evacuation method in freeing the mix of bubbles. I hope those of you having

Once the investment is set, the elimination of wax demands care: 350 C. is certainly sufficient to remove the wax. Unequal heating of the different sections of the mold may cause cracking. The same condition may result from irregularities in cooling. Every

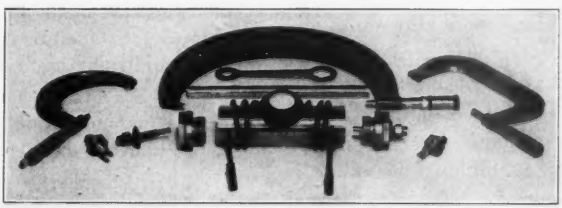

Fig. 5.—Apparatus to determine net casting shrinkage of golds. (A complete description appears in the August, 1926, issue of the Dental Cosmos.)

test we have made points to the necessity of casting into the hot mold. If you use a 40 per cent plaster and 60 per cent silica investment and wish to increase its porosity or modify its strength, you may do so by the addition of starch, flour, carbon or any one of a number of substances having certain individual advantages and disadvantages. The dimensional changes on heating for a 70 per cent silica-30 per cent plaster mix are charted in Figure 4.

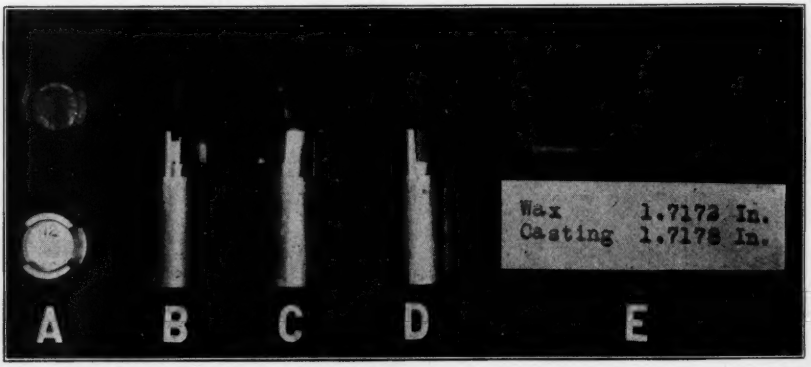

Fig. 6.—Dental castings. *A*, type of cavity and inlay. *B*, another view of cavity and inlay. Inlays made in strict accordance with a very popular technic will not fit this type of cavity (*C*). Inlays made according to the data shown in accompanying table fit (*D*). *E*, gold rod cast to dimension of a wax pattern showing application to largest dental requirement. These results are not dependent on any special alloy formula.

GOLD CONTRACTION

The contraction of a 90 per cent gold 10 per cent copper alloy on solidifying and cooling has been measured and reported as 1.25 per cent, irrespective of the normal or superheating of the alloy in casting. One of the devices used in establishing this value is shown in Figure 5. When the thermal contraction of this alloy is evaluated, it is found to be 1.6 per cent, which is definitely more than the shrinkage value observed. The first conclusion from such data would be that all factors have not been considered. This is precisely the case. Additional tests under modified conditions show this reduction of dimension by shrinkage, which is less than the thermal contraction value, to be influenced by one or both of the following facts:

1. The rigidity of some investment compounds is sufficient to reduce or resist the shrinkage markedly.

2. By modifying the sprue form, position of inlay in the mold, etc., it is possible to feed additional molten gold into the solidifying casting.

I shall have to ask you to wait for the final recommendation on these findings. While the data are correct and are vouched for, there remains a possibility of some one combination of conditions that will give maximum results in dental laboratories. We have been

criticized for offering results that were too technical for the use of the profession, but if you will follow the suggestions offered in Table 1 you will secure correct results and you can be assured that you are not injuring the work by any incorrect interpretation of data.

We hear much of new methods in alloying platinum with gold to minimize shrinkage. Then we hear of a gold alloy containing no platinum offered for the same purpose. After making a careful study of the shrinkage of a number of binary and other gold alloys used in dentistry, I am willing to predict that one shrinks about as much as the other and that neither is superior to any one of a dozen or two other alloys when rated for shrinkage.

In any event, we must know the exact shrinkage value for the gold alloy in question and the expansion curves for the wax and investment before we can hope to set up a safe technic. Until these are worked out, one must feel that he is groping in the dark and that any special result secured is, indeed, more accidental than assured, and has the possibility of being more orthodontic than prosthodontic.

RESULTS CONFIRMING CONCLUSIONS

The results displayed in Figure 6 are products of the application of the data that I have outlined. Observe that the cavity is of extremely severe form. The inlays are exactly as cast with no trimming or cutting. These results can be duplicated by a strict adherence to the method described.

This may appear rather wide of the subject of this paper, but until we develop confidence in the application of scientific data, there is little occasion to insist on a selection of materials by scientific tests. I have just described to you, in terms of individual effects, properly combined, a result that will doubtless be claimed by many operators at this convention as arising from the use of some special wax, plaster or accelerator, oven, flux, or special gold alloy. Thousands of dollars have been spent encouraging lecturers who offer special technics, recommend special materials, etc., and who give no reason or proof to justify their claims. Inlay C, Figure 6, was made in strict accordance with a technic outlined before a local organization, which spent much time and money in a sincere attempt to solve the inlay problem. It is evident that they were offered a "gold brick." I am unable to understand the lack of interest by some individuals in consistent, fundamental research looking toward the establishment of standards for materials and technics. Perhaps most investigators are too anxious to get results and do not enjoy working through complications, following up details and meeting unexpected difficulties. It should be a great pleasure to work through the individual influences governing a subject so much disputed as the foregoing, or as are the subjects of dentures, solders, cements, etc. The data secured will protect you in your practice. Such programs are not recommended for each individual dentist, but his interest and the support of his research club are necessary, if worthwhile progress is to be made.

CHEMICAL ANALYSIS

Bureau of Standards Scientific Paper No. 532 by Mr. W. H. Swanger, research associate, gives an accurate

method for analyzing the complex gold alloys, the first reliable method developed for such analysis. Synthetic formulas from standard chemical solutions were made up and analyzed. Definite alloy formulas were weighed out, melted and analyzed. These were found to agree with the known formulas. When the outline developed by Mr. Swanger is followed, the items of inaccuracies and discrepancies previously charged to melting losses will disappear. I make this statement fully aware of the many claims that this alloy or that alloy cannot be analyzed.

Chemistry must not be neglected. Uniformity of product, purity of product and accuracy of control are thus detected. Let me illustrate: In one sample of alloy, fine particles of rhodium were found which appeared to be uncombined with the rest of the alloy. Manifestly, the melting was faulty. Such discrete particles could easily weaken a clasp or margin and cause failure in the most carefully constructed restoration. Nine times out of ten you would accept a failure of this type as the fault of your laboratory or of the patient, whereas the fault is with the material and, so far as you are concerned, should be charged to improper selection of materials.

Formulas of plaster investments, waxes, alloys, etc., are being announced from time to time in our progress reports. By a careful study of these in connection with the corresponding physical properties, you will be able to make deductions as to the effects of variations of percentages of an element, to decide on the purity or care in manufacture and the completeness of the manufacturing process, to lay out manipulation details with exactness, and finally to think in terms of properties rather than in terms of trade names.

Purchases of dental amalgam alloy, for use by the U. S. Government, are now made upon the basis of compliance with a definite federal specification[4] for this particular material. No difficulty is experienced in securing material complying with the specification.

Can you imagine a steel chemist lecturing in terms of Smith's steel for one use or Brown's alloy for another? Wouldn't it be more reasonable to expect him to say a chrome-vanadium steel or a carbon steel or a case-hardening steel of such and such percentages of the elements in each instance? Today, the steel, brass, bearing and other leading industries are talking in terms of compositions and properties rather than in terms of brands. A few years ago, one seldom thought of ordering these materials by composition. Today, the practice is quite regular. The high grade manufacturers have not suffered from the transition.

Selections of structural materials should be on the basis of performance. The performance can then be related to chemical composition. After establishing the identity of chemical compositions, the next comparison may call for inspections of microstructure. Unfortunately, dental literature shows a reversal of this procedure. Comparisons are made on structures and materials of utterly unknown or different chemical compositions, with absolutely no regard for variations in composition, mechanical or heat treatment, and

4. Federal Specifications, Board Specification No. 356.

because the microstructure happens to agree or disagree, all types of approval or condemnation are made.

TENSILE TESTS

For a number of years, tensile strength tests were considered sufficient for rating steel, brass and other materials. Tensile ratios are secured by comparing elongations with loads, as shown in Figure 7. From such curves, many data are available. Naturally, ultimate tensile strength gives the maximum strength of the specimen. Repeated tests on additional samples give an idea of the uniformity of factory control or of laboratory control in case tests are being made on finished restoration.

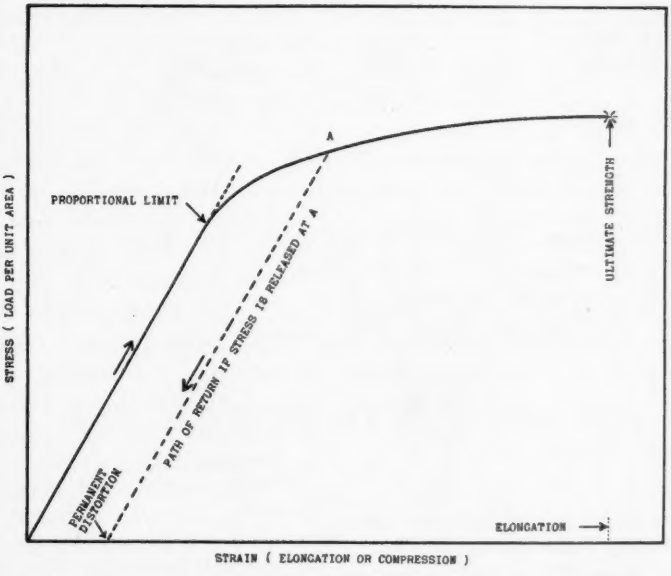

Fig. 7.—Hypothetical stress-strain curve. Valuable data are available from stress-strain curves.

One of the most important values to you is the set elastic limit; i. e., the highest stress or greatest deformation from which the specimen will return to its original form after the stress is removed. If stressed above this value, the appliance is permanently deformed. Manifestly, stresses above this value will destroy your efforts on adaptation. It gives proof of the suitability of a material for use in clasps, plate or bridge work. The flexure or service ranges of alloys are instantly comparable from these data.

Total deformation or total load on rupture gives the point below which all adjustments must be made. The percentage or relative amount of elongation establishes the ductility or amount of cold work that can be done without

rupture. Elongations carried repeatedly beyond the set elastic limit but not up to the rupture point may injure the material if not corrected by proper heat treatments. This field seems to have been sadly neglected in dental research.

It should be remembered that compressional tests, while not so satisfactory as tensile tests, are often made when materials are not available in sufficient quantities or are too brittle for satisfactory tensile tests. The test on dentin is a good example of such a case.

An approximation is often made by assuming the set elastic limit to be at or near the proportional limit; i. e., where the deformations cease to be proportional to the load applied. Figure 7 shows the location of the proportional limit. In this figure, the elongation shown is the total elongation, and it includes both the elastic and set elongation. A discussion of the technical aspects of these values or definitions is not necessary at this time.

DENSITY

I am not convinced that the importance usually placed on density of material is justified. The fact that one material has a density of eight and another a density of nine, without data on the other properties, does not convince me of the applicability of either.

Previous reports have shown the relations of hardness values, chemical compositions, tensile strength, etc. Likewise, there has been shown the lack of justification for excitement over claims of effects said to be secured by or caused by segregation, oxid contamination, acid treatment, nonshrinking alloys, etc.

You may rest assured that if a nonshrinking or minimum shrinking gold alloy is produced or any revolutionary technic perfected, it will be possible to describe it in definite terms, chemical formula or exact physical measurements, showing the effects of each step. Unfortunately, a number of theories on manipulations must be abandoned if the profession is to get the best results. This will prove a difficult experience for many; but facts, data and verified performances must replace guesses, part truths, claims and smooth presentations.

You are now in a position where you can answer parts of the five questions[5] raised at Dallas regarding the Bureau's activities in this field. Your answer will determine, largely, our future program in this field.

CONCLUSIONS

As a guest of your Congress, I want to urge a more intensive interest in the subjects of physics, chemistry and metallurgy. They are powerful instruments for the elimination of the confusion and contradictions now so evident. They are your most efficient tools for advancement in the field of mechanical dentistry. They must be used by you and not for you. I am pleading for a familiarity with the laws governing dental materials, for honesty and completeness in the interpretation and display for experimental work, for technics based on accurate data and a selection of materials yielding most in the scope of desirable qualities. Hasty attempts to adopt such a program will fail unless time is taken, first, to become acquainted with the details, and then to work out the changes in terms

5. McMahon, T. G.: Disc. of Souder: Footnote 2, p. 516.

of practical or attainable methods. The transition will come to your field just as it has come to other industries and professions. Some of your colleges are now planning for more experimental work in these subjects. Dental metallurgy is ready for an overhauling and soon will be rid of the overemphasis on mining and refining of metals, as a number of texts lead one to believe that it is studied and taught at this time. It will then be blended with physics, chemistry and engineering as a related and coordinate science. Dentists brought up under such instruction and training will not feel helpless in selecting the best material and technic for the case presented, but will be on an equality with the physician who prescribes standardized medicines in strength and doses approved by the experts of his profession. They will specify the composition wanted and will insist that it come up to a standard of performance, just as is done in other professions. Restorations will then restore as completely as it is possible to restore. You will have the satisfaction of knowing that you have truly used the best and that your patient has received all it is possible for dental science to give.

THE STRUCTURES OF THE MOUTH AND THEIR DEVELOPMENT, AS FACTORS PREDISPOSING TO MALFORMATIONS, FOCAL INFECTION AND DEVELOPMENT OF TUMORS*

By PHILIPP FISCHELIS, M.D., Philadelphia, Pennsylvania

THE normal structure of the parts constituting the mouth, particularly the teeth, and their development, as well as the deviations from the normal standard in pathologic conditions, manifest most interesting and fascinating peculiarities, from the theoretical as well as from the practical point of view. It must be kept in mind that, in regard to the general principles underlying these structures, they do not differ from other regions of the human anatomy, and it must be quite obvious that a study of these structures, when carried on from a broad biologic point of view, may enlighten us in regard to problems confronting us in the study of other parts of the body. If such results could be obtained, it would certainly help to bring home more convincingly the interdependence of dentistry and medicine, and add one more proof of the mutual help accruing if the medical man and the dental man are conversing in a language which they can both understand.

To make the point which I am trying to get at more explicit, permit me to trace briefly some of the problems in the large domain of medicine, dentistry included, and to point out some

*Read before the Section on Anatomy, Physiology, Materia Medica and Therapeutics, Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

of the phases in the gradual development of these problems.

The brilliant enlightenment which followed the establishment of the cell doctrine during the first half of the last century has spread its stimulating influence throughout all the branches of the great science of biology. With the help of the continually improved optical aid of biologic research, the microscope; with the conception of the ingenious idea to use animal and vegetal substances as dyes in studying tissues and cells; with the great discovery of the aniline dyes, which very soon were used extensively in the domain of biologic research work, the marvelous architecture manifested in the various structures in the bodies of all living organisms has been revealed.

It is well for us to emphasize here the fact that, during that glorious period in which the foundation of general and special microscopic anatomy was laid, the study of the structures of the mouth engaged the attention of the various investigators just as much as the study of the structures of any other part of the body, no distinction being made between medical and dental subjects. I think we can admit without hesitation that all our knowledge about the structure and development of the teeth in general, about the marvelous architecture of the enamel and dentin, etc., has been acquired at that period, and there has hardly anything of fundamental importance been revealed in this domain within the last almost three quarters of a century, and the old points of controversy still constitute the burning questions of today.

To illustrate the fact that the investigators of that time manifested their interest in all parts of the body alike, I wish to recall to you "Stricker's Manuel of Histology," in which we find that one author, Waldeyer, has written the chapter on the histology of the ovaries and fallopian tubes and also the chapter on the structure of the teeth, chapters of equal brilliancy and elucidation and of lasting value. This was possible only because the efforts were principally focused on the one common goal; namely, to establish the common plan which underlies the endless external variety manifested by the structures of the body, dominated by the all important cell doctrine, which was the key to a common language that all the investigators spoke and made them understand one another.

It was quite natural that the brilliant achievements in revealing the structures of the body in its normal state should lead gradually to an extensive study of the structure of various parts of the body in the manifold manifestations known as diseases. It was soon found that, in various diseases, there can invariably be observed well-defined deviations from the normal standard in the tissues and the cells of the parts affected, and that these pathologic manifestations of structure could very well explain the pathologic manifestations observed clinically. Thus, we see the cell doctrine spreading its beneficial influence into the backbone of the large domain of medicine and establishing the fact that, at the bottom of all diseased conditions, there is a cellular pathology, a principal enunciated by Virchow in his well known book published in 1858. It would be getting entirely out of the scope of my intended contribution at this time to go into the details of a period of over a quarter of

a century regarding a tremendous amount of exceedingly fruitful research work that followed the establishment of the principal of cellular pathology, upon which all modern medicine is based. I do consider it appropriate to emphasize here the fact that, in revealing general principles underlying pathologic manifestations, the study of the structures of the mouth has played a not insignificant part. I have particularly in mind the study of the origin of the deformities of the palate, and the origin of benign and malignant growths in that region; also the fundamental and elaborate contribution to our knowledge of the character and origin of cancer on the lip, published by Thiersch in 1865.

There is one important aspect in the situation to which I wish to call your particular attention at this moment. The establishment of the doctrine of cellular pathology as the foundation of medicine, the rapidly growing store of accurately observed facts in pathologic histology, the application of the experimental methods used in normal physiology to the study of abnormal conditions, creating a new science known as pathologic physiology, by Cohnheim—all these factors together have helped to develop for the first time an intelligent understanding as to how normal structures of the body become diseased. This period constitutes one of the most conspicuous and rational turning points in the history of medicine, but there was one conspicuous gloomy feature which cast a shadow on this glorious period of its enlightment. While the development of diseased conditions came to be pretty well understood, the fact that the main object in medicine is the healing of the sick was lost sight of. Pathology became a synonym for medicine, but the patient as an individual afflicted with a disease and seeking aid remained in the background, was almost forgotten as it were. Medicine in respect to its function as an art of healing the sick was in a period of nihilistic tendencies.

I wish here to emphasize this particular point because this seems to me to be one of the reasons, if not *the* reason, why, at this period, dentistry lost its kinship with general medicine as a healing art, and continued on the road of practical achievements independently and single handed. Being unable to receive any encouraging help or suggestion from general medicine in regard to the treatment of diseased conditions occurring in its domain, dentistry turned all its efforts to the development of greater efficiency in that direction in which it had already attained considerable progress; namely, to the mechanical part of dentistry. Perfection in making and fitting artificial dentures, became the main occupation of the dentist, and this branch of the profession developed to the high state of efficiency which has made this country so famous. The medical, theoretical or scientific aspect of dentistry was with few exceptions entirely wanting. Dental schools reflected the spirit dominating the profession by having a curriculum of only two years' duration in which the technical side of dentistry was mainly taught. The theoretical or scientific branches were presented in a limited number of mainly didactic lectures, and the preliminary requirements for entering dental schools were low. This was also reflected in the attitude of the students that any other subject

but the purely practical ones are entirely unnecessary, constitute a drudgery and should be done away with entirely, a conception that unfortunately is still held by many dental students.

While such a state of affairs was existing in medicine and dentistry, the latter part of the last century had witnessed the birth of a new offspring in the domain of biology, which has developed with amazing rapidity: bacteriology. Owing to its manifold points of contact with questions of enormous practical importance to the welfare of mankind, it had attracted the attention and interest of many brilliant minds throughout the world, and, in the amount of research work done and the important results obtained, bacteriology soon overshadowed and left behind all other branches of biology. Bacteriology gave us an inside view as to the origin of infectious diseases. It revolutionized entirely the whole domain of surgery by revealing the principles of asepsis and antisepsis, which made it possible to attempt and successfully perform operations never dreamed of before and to reduce the mortality after surgical operations to a very low mark.

The most important feature resulting from the development of bacteriology was the establishment of scientifically founded principles for an entirely new aspect of the practice of medicine; namely, the possibility of prevention of diseases. As preventive medicine has been shown to be equally applicable in all branches of the healing art, it could not happen otherwise than that the new movement should also invade the domain of dentistry. Soon the interdependence of the oral cavity with the organs in other regions of the body had been established beyond any doubt, and the fact that various diseases in the oral cavity, particularly of the teeth, may be the primary cause for secondary diseased conditions in other parts of the body, and vice versa, had been convincingly demonstrated.

Here, an obvious line of contact and interchange between the various other branches of the healing art and dentistry has been clearly established. At present, dentistry and the other specialties of medicine are jointly watching the ports of entrance of disease-carrying germs, and are uniting their efforts to combat the common enemy. There is a common goal to which they are all striving. They all converse in a common language, understood by all of them, and it is difficult to conceive that an estrangement between dentistry and medicine can ever occur again.

Along with the development of bacteriology, the scientific world was overwhelmed by another great discovery, with a wide range of possibilities for practical application, and that was roentgenology. This science reveals to us means to penetrate into the depths of organs and tissues and to establish normal or abnormal conditions, without the necessity of performing exploratory surgical operations. What has already been accomplished in this new science reveals it to us as another connecting link between dentistry and the other branches of medicine, and demonstrates the mutual aid that can be derived when they strive hand in hand for a common goal. Roentgenology made us also realize our still great ignorance in understanding many mysterious phenomena occurring in Nature.

The more we know about the forces to which these phenomena are due, the more we attempt to learn how to harness them for the benefit of mankind. The further study of these forces, and particularly of the reaction of the body toward them in health and in disease, constitutes an immense field, in the cultivation of which, for combating afflictions in the human body, dentistry is designated to participate, at least as much as any other of the medical specialties, if not more.

Appreciating fully the tremendous enlightment in the domain of medicine at large, we are reminded of the truism, "History repeats itself." Allured by the fascinating accomplishments in the domain of bacteriology and roentgenology, medicine has again, for a time, almost forgotten that the ultimate object of all their efforts is the living human body, which consists of numerous varieties of tissues made up of innumerable combinations of living cells, all responding in their peculiar way to the action of all the various known and unknown forces of Nature and in their interaction with one another.

The modern achievements from the study of the phenomena of internal secretion, basal metabolism, and also the newer approaches to the solution of the problems of cancer indicate convincingly the vast amount of reliable information about the life manifestations in the cells and tissues still needed to understand fully the economy of the human body. By paying particular attention to the structures of the mouth and their development as factors predisposing to malformations, focal infection and development of tumors, dentistry can help to accumulate the necessary information.

Notwithstanding its brilliant achievements in benefiting mankind, medicine, and particularly surgery, has many sins to its credit, the most important of which is the unnecessary removal of various organs of the body. We are now in the midst of a wave sweeping with alarming velocity through the practice of medicine; the too frequent removal of tonsils, the function of which is still a mystery, and the too frequent removal of teeth, the value of which can mostly be appreciated by those who have lost them. Dentistry, equipped now with all the modern knowledge of methods for diagnosis and treatment in the school curriculum, can and should help to calm that wave. We must always keep in mind that the ideal in medicine is "restoring to health and prevention of disease" and not the indiscriminate removal of vital organs. Dentistry is confronted with the opportunity to gain for itself proper recognition, to occupy an envious place in the domain of the healing art and to win the commendation of posterity.

THE STRUCTURE OF ENAMEL AND DENTIN WITH REFERENCE TO THE PATHOLOGY OF THE TEETH*

By J. HOWARD MUMMERY, F.R.C.S., L.D.S., D.Sc., London, England

THE intimate connection between histology and pathology requires that a thorough knowledge of the microscopic structure of the tissues be the foundation of all research on their pathologic processes. This applies to every organ of the body, and the teeth are as much a part of the human economy as every other tissue that helps to build up its complex structure, and they must necessarily be under the control of the same physiologic and chemical laws by which the whole system is regulated.

The views that have been so generally held as to the histologic structure of dentin and enamel, especially of the latter, have contributed to a great extent to the lack of appreciation of the influence of the body fluids on the nutrition of the teeth and on their power of resistance to deteriorating influences.

In considering this question, we may, in the first place, refer to the points in the structure of these tissues which have an especial bearing on their nutrition, and consider what the channels are by which materials necessary for the maintenance of their functional activity are supplied.

Dentin.—We may consider, in the first place, how the structure of the dentin favors the maintenance of the nutrition and vitality of the tissue. The fibril is a process of the odontoblast cell. At an early stage of development, the round cells of the pulp are seen to become differentiated at the margin into a layer of larger cells, which develop processes, the principal or distal process forming the fibril of the dentin. This fibril is surrounded by a clear substance secreted by the cells of the pulp in which calcification takes place by a gradual invasion by globular masses of lime salts, which coalesce and form the calcified matrix. The fibril thus comes to be surrounded by solid material but does not form a continuous although uncalcified portion of the matrix, as was supposed when the conversion theory held sway.

In the finished dentin, this fibril, therefore, lies within a tube, which it does not completely fill, and as no spaces exist in the living body which are not occupied by lymph from the circulating blood, this space must necessarily seem to convey the lymph to the dentin.

No absolute demonstration of the existence of this space between the fibril and the tube wall was given until Fritsch and, later, Hanazawa, showed that gelatin root mixtures could be

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made to penetrate between the fibril and the tube wall. These experiments were carried out on teeth out of the mouth, and pressure from the pulp cavity of from five to ten atmospheres was employed. The researches of Dr. Fish[1] show that particles of India ink may be carried into the lymph spaces by the circulation. These experiments were carried out on the living dog, and no pressure was employed. It is shown that there is a natural flow of lymph, carrying the ink particles with it into the lumen of the tubes. I need no more than allude to this work, as Dr. Fish is contributing a further communication[2] on his researches to the Congress. This appears to be an important point in the anatomy of the dentin of which mention has been made only in recent years; for it establishes the evidence of a direct channel from the blood to the hard tissues, and has a direct bearing on the reaction of the pulp to stimulation or irritation. The fine divisions of the tubes would carry lymph to every portion of the dentin; for these innumerable subdivisions are everywhere seen and, contrary to former statements, are as abundant near the pulp and beneath the enamel as in the dentin of the root, but in the deeper parts of the dentin require more prolonged treatment, with special staining processes, to demonstrate them. I have succeeded best with silver nitrate reduced with pyrogallic acid. These subdivisions form an intricate network both beneath the cement (many entering the spaces in the granular layer) and beneath the enamel, where many enter the conspicuous bundles or whorls at the dentin-enamel junction.

The well-known occurrences of zones of translucency in the dentin, which have long been recognized as due to a reaction of the pulp to the invasion of the dentin by caries, as well as to irritation caused by severe attrition, are seen only in teeth with living pulps. The evidence that these zones are due to further calcification in the dentin is strong. These areas show, in most places, no penetration by stains, especially when the capillary attraction method of Dr. Beust is made use of. The slight penetration of these zones seen in places is probably due to the fact that the reaction of the pulp is not complete in that area. The deposition of the lime salts would probably take place both within and around the dentinal fibril, and the organic fibril of the dentin is known to contain lime salts normally. (Gottlieb.)

Enamel—There is probably no tissue that has given rise to so many contradictory statements, so many hastily formed conclusions, as the enamel. We have been authoritatively informed that it contains no organic matter, that it is a dead tissue uninfluenced by any body changes, serving only as a resisting barrier, to form a protecting wall for the rest of the tooth. I was shown long ago by Von Ebner, Caush, Beust (the author) and many others that enamel can be stained both from within and without, and J. Leon Williams, in a recent paper, stated that his views as to the impervious nature of the enamel, which he so strongly advocated, were

1. Fish, E. W.: Proc. Roy. Soc. Med. (Sect. Odontol.) 18:35-37 (Aug.) 1925.

2. Fish, E. W.: Circulation of Lymph in Dentin and Enamel, J.A.D.A., to be published.

due to neglecting to use staining methods in the examination of the teeth. He says that he finds every part of the enamel, both the defective and perfectly formed substance, penetrable by stains.

It was suggested by Dr. Laidlaw that a method of decalcifying enamel might be devised and that, by suitable imbedding processes, the decalcified tissue might be held together. This, after many experiments, was successfully carried out by H. C. Matteson, and it revealed that the intimate structure of enamel was considerably different from what had hitherto been described. It is seen that the prisms (or rods of J. Leon Williams) are bounded on either side by a narrow sheath or cuticle, which was not identical with the interprismatic substance but was interposed between it and the prism. The interprismatic substance appeared to be densely calcified, while the prism cuticle was much less so. This seems evidence that this cuticle or prism sheath is of an organic nature, as it remains after decalcification and stains deeply with hematoxylin, and, as Matteson believes, probably forms the bulk of the organic content of the enamel. Exactly the same details of structure were shown in a tooth that had been prepared by me by the Weil process more than thirty years ago. The section was removed from the balsam and the balsam removed with xylol. It was found to be soft and completely decalcified by the prolonged action of of the acid balsam. J. Leon Williams, in a recently published paper on mottled enamel, showed that this structure is also revealed by the action of the decalcifying agent in this obscure disease. These investigations have considerably advanced our knowledge of the true structure of enamel.

With regard to the penetration of enamel by stains, there are two main points to be considered: Is it due to the presence of organic matter in the calcified tissue or to spaces or intervals between its elements which allow the passage of fluids, or is it due to both conditions?

The numerous communications between the dentin and enamel at the junction line of the two tissues convey stains into the enamel, especially evident in the bundles of whorls in this situation. The stain is most intense in the center of these whorls, and spreads out into the enamel in spirals, traversing lines between the prisms that are in all probability those of the prism sheath or cuticle. As in the dentin, it is shown that there is a space around the fibril conveying lymph, and as these spaces in the enamel are continuous with the lymph spaces in the dentin, one would imagine that they must necessarily carry the lymph to the enamel as they do to the dentin. If, by further researches, this can be actually demonstrated, it will leave us no longer in doubt as to the vitality of enamel. In a recent paper, I have described areas in the enamel which appear to be in every way identical with the translucent zones in the dentin and, as described in that paper, showing strong evidence that they are due, as is considered to be the case in the dentin, to a further deposition of lime salts as a defense against the first inroads of caries. Are we to consider that we have here the evidence of a vital reaction on the part

of the pulp shown in the deposition of lime salts?

J. Leon Williams, while admitting the possibility that a fresh deposition of lime salts might take place in the enamel through these communicating channels, says that there is no evidence that such a change really occurs. He states that no proof has been brought forward, either by means of the microscope or by chemical analysis, that there has been any sort of calcific deposit in areas where the enamel tissue is defective. He considers that metabolic changes cannot occur in the enamel and dentin in the absence of cells.

According to Bayless, "Schwann introduced the name metabolic to express the chemical changes which the constituents of the body undergo." In this wide sense, it does not seem advisable to look on metabolism as impossible in the absence of cells. Such changes as take place may affect the constituents of the cell itself or the surrounding material. The cells of the pulp separate the lime salts from the blood, and the dentinal fibril is a process of the cell and, therefore, a constituent portion of it. Other processes and agencies of a chemicophysical nature are also active in the tissues, such as capillary attraction and diffusion. Absorption also plays an important part in the deposition of substances at which changes in surface tension occur. The surfaces in both enamel and dentin where absorption and other surface phenomena take place are numerous. Not even a circulation of lymph is necessary for some of these phenomena to take place, but, as it has been shown that lymph passes along the dentinal tubule, and as the channels in the dentin also pass into the enamel, the possibility of there being an actual circulation of lymph both in enamel and dentin may be considered.

The diffusion of lymph into the enamel has been actually demonstrated and is being described by Dr. Fish[2] during the present session of the Congress.

We may, therefore, consider that as we have in the teeth the conditions for procuring chemicophysical changes in their substance independent of the direct action of cells, these processes will not be inactive during life, neither enamel nor dentin being tissue that is thrust out, as it were, from the living body and serving only a mechanical purpose. One cannot but think, therefore, that such changes as are described in these zones are, apart from their actual demonstration, highly probable and explainable by the presence of the chemicovital agencies above referred to. We should consider that the actual occurrence of the zones supplies at least the microscopic evidence which Dr. Williams asks for.

It is somewhat difficult to understand the statement recently made that "structural features may influence the rate of decay but have *no bearing* on the tendency of the teeth to decay."

We know that the acid fermentation of carbohydrates in the mouth appears to be the one active determining cause of caries at the present time, but we must consider that defects in structure are important predisposing causes, if, by a predosposing cause, we mean a condition that lays a tissue or organ open to the attacks of disease.

We know that lowered resistance is a predisposing cause of many diseases, and it certainly appears that structural defects would be one cause of lowered

resistance and, therefore, a predisposing cause of caries.

The intimate relation between the nature of the diet and the structure of the teeth has been definitely shown, especially by Mrs. Mellanby's researches. The administration of food defective in certain elements has been shown to be a cause of defective structure. The chief controlling factor in the diet appears to be a vitamin with properties and distribution similar to those of vitamin A, and contained in abundance in cod-liver oil.

In her experiments on puppies, Mrs. Mellenby showed that when a diet was deficient in the calcifying vitamin, and especially if there was at the same time an excess of cereal, the dentin was very imperfectly developed and the enamel chalky and ill formed, but that when a diet containing the necessary vitamins was substituted, the next deposited dentin and enamel were well formed. There seems no doubt, therefore, that diet has a pronounced effect on structure. The question then arises as to how far these structural defects render the teeth more liable to decay. In an examination of deciduous teeth, the same author showed that there is a distinct relation between structure and caries; that teeth of defective structure are much more likely to be attacked by caries than those which were properly formed. Statistics showed that, while this held good in the great majority of cases, teeth of good structure were, in a few instances, carious, and a few of defective structure were free from caries.

It would appear that, since the diet of civilized peoples has grown farther and farther away from natural products which tend to contain more calcification-controlling vitamins, the teeth are less well calcified and, after eruption, less able to resist disease. This would indicate that, while defects in structure appear to be, at all events in modern times, by far the most important predisposing cause of caries, there must be other factors to be considered which are concerned in the immunity or susceptibility of the teeth to caries.

In studying the pathology of this disease, we cannot but think that attention has been confined too much to the action of the acids of fermentation in the mouth, which we acknowledge to be the determining cause, and that the resistance of the body has not been sufficiently considered, the proper balance between secretion and excretion, the normal functioning of the endocrine glands (as yet so imperfectly understood) and other conditions connected with nutrition and environment, which call for further investigation.

It is difficult to understand why, as carbohydrates have formed a portion of the diet of man from very early times, caries was not earlier met with, and it might be suggested that, in the course of time, owing to changes in the nature and condition of these foodstuffs, the bacterial flora of the mouth may have become much modified and the acid producing bacteria have obtained the upper hand.

The reaction to external irritation conveyed by the pulp in caries and the apparently dense deposition of lime salts in the dentin in arrested caries suggests, as Mrs. Mellanby says, that "the mechanism of dental defense controlled from the pulp and the inside of the tooth is of great importance and demands consideration in any study of the etiology of dental caries."

TECHNIC OF FILLING CAVITIES IN THE PROXIMAL SURFACES OF INCISORS AND CUSPIDS WITH GOLD FOIL*

By CHARLES E. WOODBURY, D.D.S., Council Bluffs, Iowa

THERE is possibly no class of cavities in which gold foil is so strongly indicated as those in the proximal surfaces of the front teeth. It is the one filling material that has consistently stood the test of time, and the only one that has stood the test of time in these locations. The porcelain inlay had its period of popularity, but the enthusiasm regarding it has so far waned that in only an occasional case does it seem to be indicated. The gold inlay, one of the best means that we have had for repairing the ravages of decay, has not proved an unqualified success in this locality. Neither have the silicate cements fulfilled the expectations of ten years ago. They have proved themselves simply good cements, capable of being good temporary fillings but not to be classed as permanent filling materials. Gold foil, therefore, is the one dependable filling material when permanency is of the first consideration.

Before any operation, a study should be made of the movements of the mandible. The approximate force of the occlusion is noted and the facets caused by wear are carefully studied in an effort to determine as far as possible the amount of stress that the tooth in which the operation is to be made will be compelled to sustain.

Before any cutting has been done to the tooth, it is well to spend a few moments in the study of the case, to form a mental picture of what the finished operation will be. It is sometimes a help to draw the cavity outline on the tooth with a sharp pointed lead pencil. It has truly been said that "the hand cannot execute what the mind does not conceive." A perfect conception of the finished operation before it is started enables the operator to proceed with rapidity and assurance.

The line of force is considered the most important of the various matters of technic in the making of a gold foil operation. When this line is correct, a fair operation may be made in an indifferent cavity or without much attention being paid to the stepping of the plugger; but with an incorrect line of force, no matter how good the cavity or how careful the stepping, a leaky filling results.

Especial attention will be devoted to the application of the different lines of

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*The papers of Drs. Woodbury, Waters, Blackwell and Southwell make up a symposium on "Manipulation of Gold Foil."

force and to the chair positions necessary to obtain these various lines of force in the cavities under discussion.

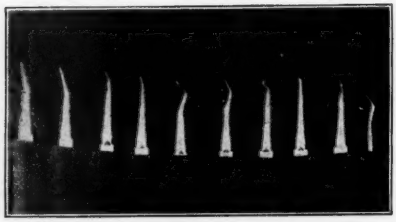

Fig. 1.—Instruments used in the operation.

The pluggers used (Fig. 1) are of the familiar G. V. Black pattern, with the exception of the two small foot pluggers, which are of the Varney type. The first is a round plugger 0.5 mm. in diameter, angle 3. The second is also a round plugger 7, 1.2 mm. in diameter, angle 3. The third is a convex-faced parallelogram, 0.4 by 0.8 mm., angle 3, shaped like a hatchet. The fourth is the same plugger, shaped like a hoe. The fifth is a contra-angled parallelogram, 0.4 by 0.8 mm., shaped like a hatchet. The sixth is like the fifth except that it is shaped like a hoe. The seventh is a small bayonet, 0.3 mm. in diameter. The eighth is a foot plugger, 0.4 by 0.8 mm., angle 14. The ninth is a foot plugger, 0.6 by 1.2 mm., angle 14. The tenth is a corkscrew assistant plugger.

Fig. 2.—Starting a filling in the axiolinguogingival angle.

The filling is started by using a small piece of gold, placing it in the axiolinguogingival point angle and catching it with the assistant plugger which enters the cavity through the lingual extension. (Fig. 2.) The assistant plugger is held in the left hand. Plugger No. 1, held in the right hand, enters the cavity through the labial extension in a line that will bisect the angle between the axial and gingival walls. Three rows of steps are run down the axiogingival line angle, ending in the point angle. Still holding the gold with the assistant plugger, the operator adds more until the gold has been built along the axiogingival line angle from its lingual point angle to the labial

Fig. 3.—The filling built across from the axiolinguogingival to the axiolabiogingival angle.

point angle. (Fig. 3.) The small bayonet plugger is used to fill the axio-

Fig. 4.—Chair position when starting the filling.

labiogingival point angle. When this angle has been reached and filled, the

Fig. 5.—Covering the linguogingival margin.

gold will be self-retaining and the assistant plugger can be dispensed with.

Figure 4 illustrates the position of the operator and that of the assistant plugger and condensing plugger.

After a foundation is obtained, a thirty-second of a sheet of gold is placed in the cavity through the labial extension and carried to the linguogingival angle (Fig. 5), one half of the piece passing through so that it will be exposed on the lingual surface. Using a small foot plugger through the labial extension with a line of force that is

Fig. 6.—Chair position when covering the linguogingival margin.

almost at right angles to the axial wall, the operator condenses the piece on the foundation. The line of stepping starts on the foundation and runs toward the linguogingival angle, the toe of the plugger pointing in the same direction. (Fig. 6.) The plugger is then entered from the lingual surface and the gold condensed over the linguogingival angle. The gold and the plugger are clearly visible through the labial opening of the cavity. The line of force is as nearly at right angles to the lingual wall as possible.

Up to this point in the operation, the position of the operator at the chair has been practically the same whether the cavity has been one that is exposed to the right or one that has been exposed to the left. From now on, his position will be very different, depending on whether the cavity is exposed to the right or to the left.

We are now approaching the crucial time in the operation. (Fig. 7.) The method of handling the gold at this time makes the operation either an easy or a very difficult one. The gold is built along the lingual wall in the shape of a gradually growing triangle, the base of which is the foundation already established. The apex gradually grows along the lingual wall toward the incisal wall. As in the preceding step, the gold is placed in the cavity through the labial opening and passed so that half of it emerges through the lingual opening. The line of force is now changed so that it is directed against the axial wall and as nearly at right angles as the approximating tooth will allow. The greatest fulness is slightly outside the cavity along the lingual margin. The gold along the axial wall

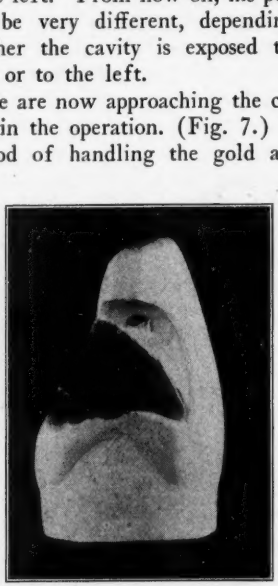

Fig. 7.—Building the gold along the lingual wall.

Fig. 8.—Chair position when condensing the gold along the lingual wall, operating from the labial in a cavity exposed to the right.

Fig. 9.—Chair position when condensing the gold along the lingual wall operating from the lingual in a cavity exposed to the right.

is slightly concave so that the gold covering the lingual wall is visible at all times through the labial opening. As the filling grows toward the incisal wall, a piece of gold is occasionally put on the axial wall to strengthen the apex of the triangle on the foundation. At no time should enough gold be added on the axial wall to obscure the gold covering the lingual margin. At all times, the gold on the axial wall should

Fig. 10.—Chair position when condensing the gold along the lingual wall operating from the labial in a cavity exposed to the left.

be slightly concave. Each piece of gold is condensed, first on the established foundation through the labial opening and then along the lingual wall from the lingual surface. The line of stepping is from the foundation toward the lingual surface. The shaft of the plugger is held as nearly at right angles to the axial wall as the approximating tooth will allow. When working from the lingual surface, the toe of the plugger first points into the cavity, condensing the gold on the lingual wall, and is then turned so that the toe points toward the lingual surface of the tooth and the heel toward the cavity, thus driving the gold over the cavosurface angle bevel. In cavities in teeth that are rotated in their sockets, it is sometimes difficult to obtain this last position with a foot plugger, and the contra-angle parallelograms are often found more convenient.

As this is the crucial time in the operation and the line of force is the

Fig. 11.—Chair position when condensing the gold along the lingual wall operating from the lingual in a cavity exposed to the left.

most important thing to be considered when making an operation, and as the line of force is made easy or difficult by the operator's position at the chair, it is important that this position be correctly assumed. When operating on a cavity that is exposed to the right (Fig. 8), the position at the chair is now materially changed, the operator passing around directly behind the patient's head. This position was determined by placing the plugger in position to deliver force in the desired line and then assuming a position in which the

hand and arm were comfortable. The field of the operation is plainly visible. The hand and plugger are out of the line of vision and do not obscure the progress of the operation.

The same position is maintained at the chair when operating along the lingual wall, the progress of the operation being viewed in the mirror. (Fig. 9.) The gold that has been passed through the labial part of the cavity and partly condensed through the labial extension is now condensed along the lingual wall. The line of force is still at right angles to the long axis of the tooth.

When operating on a cavity exposed to the left, the operator assumes a position very different from that taken in operating on a cavity that is exposed to the right. (Fig. 10.) When the cavity is exposed to the left, the operator, when working through the labial extension, stands at the left side of the chair, and the assistant stands on the right side. From this position, the line of force at right angles to the axial wall is easily obtained, and the hand and arm are in a restful position.

When operating along the lingual wall of the cavity that is exposed to the left, the operator passes around in quite a forward position on the right side of the chair, and the assistant passes around to the left side. The progress of the operation is watched in the mirror. (Fig. 11.)

The second step during the crucial time of the operation now approaches. (Fig. 12.) As soon as the incisal anchorage is closely approached, it should be filled, a small bayonet plugger being employed to take advantage of the easy access, and for the added security of the operation. Building the gold along the lingual wall toward and over the incisal wall is then continued. The gold is still placed in the cavity through the labial extension and passed through the extension so far that half of it is on the lingual surface of the tooth. The gold that covers the axial wall is still quite concave so as not to interfere with the view or the building of the gold along the lingual and incisal walls.

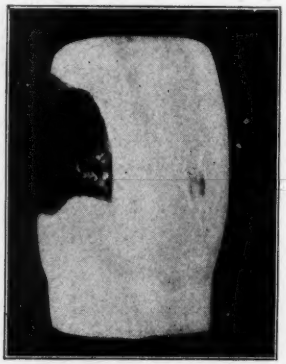

Fig. 12.—Building the gold along the lingual wall and over the incisal wall.

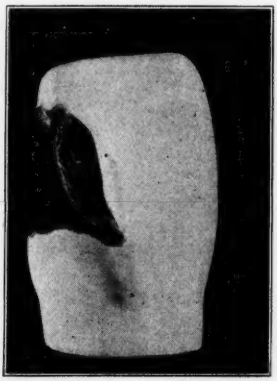

Fig. 13.—Restoring the contact point.

The line of force is changed, being directed more toward the incisal wall in order to allow the gold to flow down

Fig. 14.—Building the gold over the labial wall.

to and over the wall. When the incisal wall has been covered, the whole lingual surface of the tooth should be

Fig. 15.—Improper technic.

restored to full contour, with only enough gold covering the axial wall to hold the different parts of the filling together. One of the common errors is to have the fulness along the axial wall instead of along the lingual wall,

Fig. 16.—Incorrect chair position.

thus not only obscuring the view of the filling through the labial extension but also making it difficult to condense the

Fig. 17.—Filling making an inoperable condition at the linguo-incisal margin.

gold along the lingual surface thoroughly. Attention is again called to

the fact that these two steps in the operation either make it very difficult or very easy.

A separator is now adjusted and the gold is built through the labial opening, restoring the full contour of the tooth as it contacts with the approximating tooth, the completion of the labial wall being left until the last. (Fig. 13.)

The labial wall is now covered, the operator stepping the plugger from the gold toward the periphery, so as to allow the gold to flow toward the cavity walls and over the margin at all times. (Fig. 14.)

It is almost as important to know what not to do as what to do; to know where errors are commonly made and how to avoid them. It is the most common error in the class of fillings under discussion to make the first one half or two thirds of the filling with a line of force that is almost parallel with the long axis of the tooth (Fig. 15).

As the gold flows to a position that is at right angles to the shaft of the plugger, this line of force causes the gold to lie on the gingival wall almost at right angles to the axial wall. (Fig. 16.) The accomplishment of this seemingly easy and natural thing is insured further by a slight fear that the filling may be loosened from its gingival retention unless the line of force is such as to hold it in. If this procedure is continued a little farther toward the incisal wall (Fig. 17), a condition arises at the linguo-incisal angle that is practically inoperable. More fillings of this class fail at the linguo-incisal angles than at any other place. This is avoided by using the line of force and the technic heretofore mentioned as being employed at the crucial time in the operation.

If the filling is not firmly anchored in the gingival retention angles, the sooner this fact is discovered, the better it will be. If almost from the beginning of the operation, the line of force is at right angles to the axial wall and to the long axis of the tooth, and if the lingual and incisal parts of the filling are made before there is any attempt to fill the labial part, an operation that is difficult for most operators will be made simple and a successful result will be assured.

COMPARATIVE VALUE OF SO-CALLED PERMANENT FILLING MATERIALS IN THE CONTROL OF CARIES*

By F. H. WATERS, Ames, Iowa

THE filling materials in use at the present time for permanent operations are gold foil, cast gold inlays, amalgam, porcelain inlays and silicate cements.

The qualities most desired in a filling material for permanent operations are indestructibility in the fluids of the mouth, adaptability to the walls of the cavity, freedom from shrinkage and expansion after being made into fillings, resistance to attrition and sustaining power against the forces of mastication.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

The qualities of secondary importance are color, or appearance, nonconductivity of thermal impressions and convenience of manipulation.[1]

The value of a filling material in the control of caries and in rendering the most permanent service depends greatly on a careful preliminary study of the case in hand. The following conditions should be carefully noted: 1. The force of the closure of the jaws, particularly with reference to the tooth in which the operation is to be made. 2. The movements of the mandible and their relation to wear on the incisal and occlusal surfaces. 3. The condition of the investing tissues and their ability to withstand applied force. 4. The temperament, susceptibility and immunity of our various patients, as bearing on the treatment.

We should know the physical value of filling materials and recognize our ability and limitations in their use. A knowledge of these things is most necessary in order to determine the kind of filling material and the style of operation to be employed.

GOLD FOIL

The conditions that would indicate the use of gold foil as a permanent filling material are as follows: (1) the tooth should be fully developed in the apical region; (2) the patient must be possessed of sufficient nervous and physical strength to sit with the dam in place for from one to two hours; (3) the teeth must have reasonably healthy peridental membranes; (4) the cavities must have sufficient dentin supporting the walls so that gold foil may be wedged against them without danger of fracture, and (5) the cavities must be accessible so that the correct line of force may be obtained.

Under the existing operative procedures, gold foil is especially indicated in cavities in classes 1-2-3 of Black's classification and also of class 5 in the eight anterior teeth.

The first and principal objection to gold foil fillings is the unsightly appearance of large fillings, especially in the front teeth of young adults. Whether or not a porcelain inlay or silicate cement filling would give a better appearance in any particular case will depend on the comparative neatness of the adaptation to esthetic conditions in the two cases. As a rule, the service of a silicate cement, from the standpoint of esthetics as well as from that of a permanent filling, is very short.

A gold filling always declares itself, and is a decided blemish if the work was not neatly done. When well made and in good form, the gold filling gives an expression of neatness and good taste and will render a service far beyond that given by any filling material yet discovered. On the other hand, a porcelain or silicate cement filling that is ever so little out of form, or off color is always noticeable.[2]

In selecting a filling material, especially for cavities in classes 3 and 4 in the proximal surfaces of the six anterior teeth, it would be infinitely better to prepare the cavities in good form and make a permanent foil filling than to obliterate the shape and form of the tooth in the extensive cutting demanded for gold inlays and in the frequent replacements of silicate cements.

1. Black, G. V.: Operative Dentistry, Vol. 2, p. 224.

2. Footnote 1, p. 332.

Class 1 fillings in pits and fissures in molars and on the lingual surface of upper incisors are, I believe, made in the shortest time and are most nearly permanent when gold foil is used.

GOLD INLAYS

The gold inlay, in the hands of the average operator or one who has not had a great deal of experience in the manipulation of gold foil, in class 2 or proximal cavities in bicuspids and molars, makes a more nearly permanent filling than any material in use at the present time. This is mainly due to greater ease in the manipulation of the materials, cement filling the discrepancies, and to much wider cutting, which has the effect of laying the margins in areas of immunity.

The gold inlay is exceedingly well adapted to large restorations in broken down teeth, and, in many of these cases, a well-constructed inlay will give excellent service and avoid the placement of a crown.

In large gingival cavities in molars, I believe the inlay made by the indirect method to be the best restoration for this class of cavities as it permits all finishing to be done outside the mouth and prevents laceration of the tissues.

The success of many who are devoted to the inlay to the exclusion of all other materials is due to the extensive cutting and destruction of valuable tooth structure, and also to cutting to a much greater width than the most enthusiastic in the practice of extension for prevention had ever done. As the inlay depends almost wholly on cement for its retention, it is necessary to cut deeper for stability.[3]

3. Footnote 1, p. 333.

AMALGAM FILLINGS

The permanency of an amalgam filling depends largely on knowing the physical properties of the material with which we are working. With correct cavity preparation and proper manipulation, it is capable of giving excellent service in many cases.

Amalgam has been greatly abused. It certainly has many good qualities for the preservation of teeth. Its use conserves time, money and effort, which are often major considerations with the average patient and it holds a large place in present-day normal practice. I believe it has been estimated that 50 per cent of all fillings are made with amalgam.

There is no other filling material in use today that with so little time and effort will give such lasting results in the prevention of caries. The reason that amalgam is in such bad repute is not that it does not have excellent qualities in the preservation of tooth structure, but that owing to faulty cavity preparation, poor manipulation and inadequate finishing, it does not give long service. Gold foil and gold inlays used in the same careless manner would give no better results.

A more careful technic should be accorded amalgam as it will be without doubt, for some time to come, the filling material most used in the average practice. We should not think that we are belittling ourselves when we do commonplace things uncommonly well.

SILICATE CEMENTS

The misuse of silicate cements is today the most glaring error of our profession in rendering service to our patients. These cements are used as

permanent fillings when they possess none of the requisite qualities for restorations expected to give long service. There might be no objection to the use of silicate cements in selected locations, especially gingival third positions, in the mouths of elderly people who exhibit a high degree of immunity; but it would be almost criminal to place silicate cements in the mouths of susceptible children.

Silicate cements are gradually washed away in the saliva, and they do not maintain a sufficiently smooth surface to justify their use for proximal fillings, because a proper contact is not maintained. The average life of a silicate cement filling is probably less than two years, and the cavity must generally be larger with each replacement. The use of silicate cements in proximal cavities in the incisors is the beginning of a procedure which leads to a porcelain crown, or the loss of the tooth from alveolar abscess.

How much better it would be, for young people especially, if on the discovery of proximal decay in an incisor, the smallest possible cavity were prepared according to the rules of extension for prevention, and permanently filled with gold foil. When one studies these cases carefully, it is surprising how many of the cavities may be filled with gold without disturbing cosmetic harmony.[4]

SUMMARY

Caries of the teeth should be much better controlled than it is today. We are not using the means at hand to the best advantage. In dentistry, as in almost every other line of endeavor, we are sacrificing stability and permanency for speed and something spectacular.

We consider our patients too much for a particular series of operations and not for permanent results.

The failure of a great majority of our fillings is not due to the lack of having fillings materials that will give permanent results, but more often to improper cavity preparation, poor manipulation and inadequate finishing of the fillings, failing to obtain good form and smooth, well-polished margins. The number of unfinished fillings that we see in the mouths of our patients today is appalling.

Gold foil has proved, by the excellent service it has given over so long a period of time, to be the most reliable filling material in the control of caries, and it certainly should be used more extensively in the proximal cavities of the six anterior teeth. Its successful manipulation requires much study and careful experience, and yet, when this study is given it and the required experience has been obtained, it may be worked into fillings more perfectly than any other material.[5]

The gold inlay when used in proximal cavities and in large restorations in molars and bicuspids and in the anterior teeth that will not withstand the malleting of foil makes a valuable and permanent filling.

Amalgam, though a greatly abused filling material, has many good qualities when cavities are properly prepared and the material correctly manipulated.

Silicate cements are the most unreliable of the so-called permanent filling materials and should be used only in selected cases.

4. Black, A. D.: Prevention in Dentistry, J.A.D.A., 12:589 (May) 1925.

5. Footnote 1, p. 225.

TECHNIC OF FILLING OCCLUSAL CAVITIES IN BICUSPIDS AND MOLARS WITH GOLD FOIL*

By ROBERT E. BLACKWELL, M.S., D.D.S., Chicago, Illinois

IN considering the subject of filling with gold foil, it is necessary to give some attention to certain principles in cavity preparation, as the success of any filling depends not alone on the manipulation of the filling material but on the form and treatment of the cavity as well.

The outline form of occlusal cavities should vary with the conformation of the occlusal surfaces and with the carious condition of the teeth. All enamel undermined by decay should be broken down until the enamel wall rests on sound dentin at all points. Fissures, that is, actual faults in the enamel, that connect with the carious cavity should be included in the cavity outline. (Figs. 1-4.) In making extensions through the fissures, and, in some cases, deep developmental grooves, the cavity should be shallow, barely cutting through the enamel into the dentin. As the marginal ridges are approached, care should be exercised not to undermine the enamel with the bur. The mesial and distal walls of most occlusal cavities should be inclined to the mesial and the distal, respectively, in order to give support to the marginal ridges, and, in the case of the mesial wall, for convenience in adapting gold. (Fig. 5.)

The pulpal wall (that is, the floor of the cavity) should be flat, or in the form of a series of flat seats, which should be cut at right angles to the surrounding walls. This form offers the maximum amount of resistance to heavy occlusal stress and prevents the movement of the filling. If the cavity is deep, care should be taken not to expose the recessional lines of the pulpal horns by cutting the seat to the full depth of the cavity. In such a case, a shelf may be cut on a level nearer the occlusal surface. This will give stability to the filling and, at the same time, safeguard the pulp. (Figs. 6-8.)

The enamel wall of a cavity that is to receive a gold foil filling should be given careful treatment. In narrow occlusal cavities that follow developmental grooves, the outer ends of the enamel rods incline toward the groove; therefore, all that is necessary to secure strong walls is to cut them vertical and parallel. If the cavity is wide, the inclination of the rods is away from the cavity; and, in this case, the enamel wall should be planed to conform to the general direction of the enamel rods, and the cavosurface angle should be beveled. In all cases, the angle formed by the junction of the cavity wall with the surface of the tooth should be so beveled that it will not be injured in malleting the foil over it. (Fig. 9.) If the cavity is wide, convenience points

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

for holding the first pieces of gold securely may be made; if the cavity is narrow, such convenience form may be omitted.

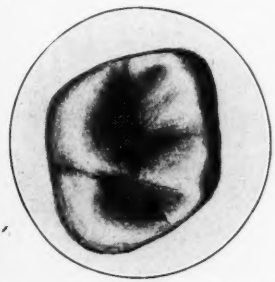

Fig. 1.—The occlusal surface of an upper first molar, showing a small pit decay. (Figures 1-9 from Black's "Operative Dentistry.")

Fig. 2.—Molar shown in Figure 1 after excavating and filling cavity.

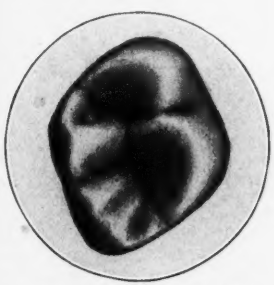

Fig. 3.—An upper molar, showing fissured grooves.

The rubber dam should be snugly in place and the cavity walls planed and freed of all débris before filling is begun.

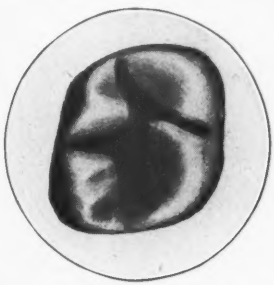

Fig. 4.—Molar shown in Figure 3 after excavating, and filling the cavity.

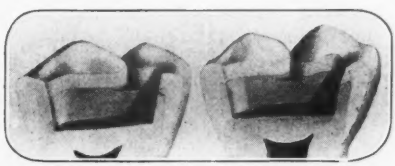

Fig. 5.—A split upper molar tooth, showing a deep occlusal cavity prepared with the mesial and distal walls inclined outward so that the marginal ridges of enamel will have supporting dentin, and, in the case of the mesial wall, the adaptation of gold will be made easier.

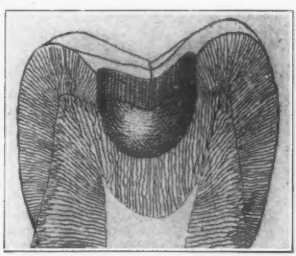

Fig. 6.—A deep occlusal cavity with a concave pulpal wall as left when the decayed material is removed.

In my experience, cut cylinders of cohesive gold foil, Nos. ¾ and 1, are the best and most convenient for filling.

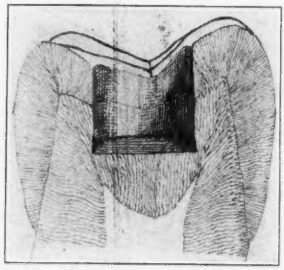

Fig. 7.—The cavity shown in Figure 6, with the dentin walls squared up to the full depth of the decayed area. The proximity of the cutting to the the recessional lines of the marginal crests of the pulp, which may be traced in the picture, shows that, to square up the dentin walls to this depth, would be a very dangerous proceeding, because of the great liability of exposing the horns of the pulp.

The gold should be thoroughly annealed, preferably on an electric anneal-

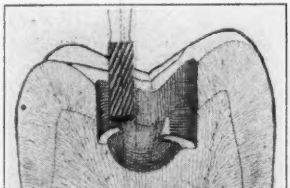

Fig. 8.—Employment of the fissure bur for squaring up the dentin walls and cutting a ledge around the deeper part of the cavity.

ing tray, to develop its full welding property. For the placing of the first pieces of gold, a serrated round plugger point 0.75 mm. in diameter may be used in conjunction with a gold holding

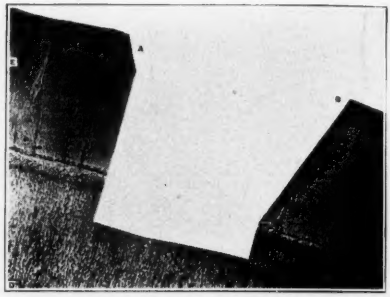

Fig. 9.—Section of enamel through which a cavity has been cut into the dentin. *B*, a strong enamel wall with a strong cavosurface angle; *A*, an enamel wall cut in such a relation to the enamel rods that it would be very frail and liable to chipping without the bevel of the cavosurface angle shown at *A*.

instrument, having a nib of approximately the same size. The packing of

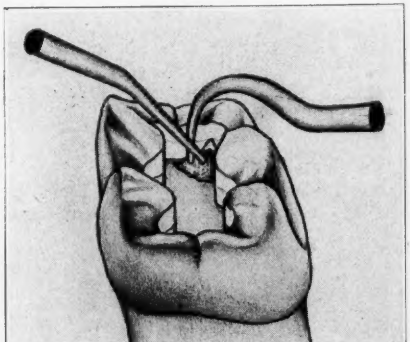

Fig. 10.—Employment of the round plugger and assistant plugger in starting the filling.

gold should begin in the distal portion of the cavity so that the convenience

point, or the most accessible point angle, is filled first. (Fig. 10.) Then the gold is gradually built along the disto-pulpal line angle to the opposite wall. (Fig. 11.) This may be done with hand pressure, as the amount of force required to condense gold with this plugger is not greater than 8 pounds. The plugger point should now be changed to a parallelogram nib, 0.10 by 0.5 mm., and the hand mallet should

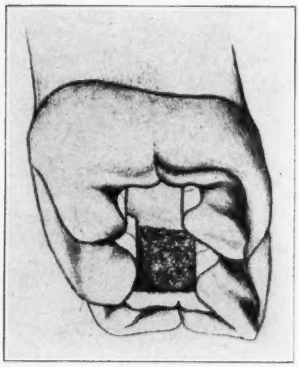

Fig. 11.—Tooth in which the disto-pulpal line angle is covered and the gold has been wedged between the buccal and lingual walls.

be employed instead of hand pressure. The succeeding pieces of gold should be added in such a way that a portion of the pellet is welded to the gold previously placed and a portion of it extends out over the pulpal wall. The direction of force at this time should be toward the distal and never at right angles to the pulpal wall, since that would cause the gold to curl away from the cavity floor and be poorly adapted. (Fig. 12.)

The principal reason that gold foil has long been considered preeminent as a filling material lies in its ability to take advantage of the elasticity of the dentin. In the words of Black, "It may be adapted to cavity walls with great force and is capable of immediately and permanently sustaining that forcible adaptation." Hammered gold can push elastic dentin walls aside when the mallet force is properly applied. Malleted gold is sufficiently solid to resist the rebound of the elastic dentin

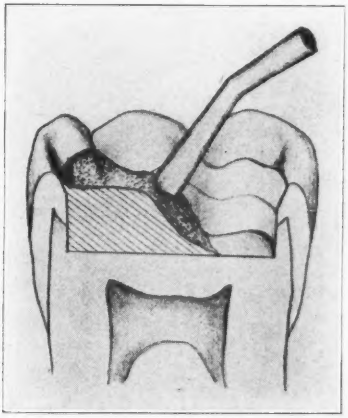

Fig. 12.—Building the gold from the distal to the mesial, using a parallelogram plugger with a convex nib.

wall. Therefore, the dentin exerts a grip on the body of gold which makes for good adaptation and great stability. In order that full advantage may be taken of these properties in building a gold filling, the plugger should be advanced in a series of steps from the center of the cavity toward the dentin wall, being moved each time just the width of the working point after two quick blows of the mallet. As the cavity wall is approached, the shaft of the instrument should be inclined more and more with each step of the plugger,

so that, when the last blows are struck at the dentin wall, the shaft will be inclined at an angle of from 6 to 12 centigrade with the cavity wall. (Fig. 13.) This stepping of the plugger in rhythmic movement from the center of the mass toward the cavity wall, in perfect coordination with the blows of the hand mallet, makes for evenness of condensation, accuracy of adaptation and speed in operating. Dr. Black has stated that it is the close and definite appreciation of the relation of lines of force to the planes of cavity walls that brings excellence in filling teeth. In occlusal cavities, there should be no great difficulty in obtaining with direct acting instruments that angle of approach that will give the best adaptation to cavity walls. In molars, gold cannot be well adapted to the mesial portion of the buccal wall and the buccal portion of the mesial wall, without the use of a reverse action plugger or a right angle hand-pressure plugger. To overcome this difficulty, the cavity should be completely filled from the distal to the mesial wall, with the exception of the portion near the mesiobuccal angle. This unfilled portion may then be filled accurately and quickly by hand pressure with a right-angle plugger having a nib 0.5 mm. in diameter. The force required to condense gold with this plugger is less than 5 pounds, but the average operator can and should use more pressure in wedging these last pieces of gold between the bulk of the filling previously placed and the cavity wall. (Fig. 14.)

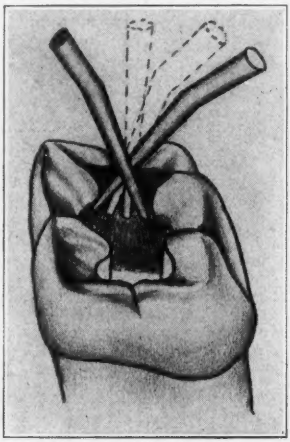

Fig. 13.—Position of plugger at the beginning of a series of steps, shown in outline. The pluggers are shown at an angle of 12 centigrade, with the buccal and lingual walls, respectively, in making the last condensation against these walls.

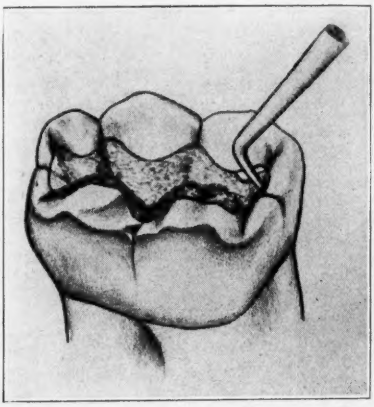

Fig. 14.—Use of the right angle hand pressure plugger in adapting gold at the mesiobuccal angle.

The cavosurface angle of the cavity should be covered with a fairly thick and somewhat loose mat of foil so that the gold will not curl away from the enamel while it is being finally condensed, and in order that the enamel

margin may be protected from injury by the blows from the mallet. A foot plugger, or a parallelogram plugger, with a convex nib, should generally be employed in condensing gold over the enamel margins, as there is less likelihood of injuring the enamel with these instruments.

Finally, the entire surface should be malleted thoroughly with a 0.5 mm. round plugger in order to harden the gold and enable it better to resist occlusal wear.

In finishing occlusal gold fillings, it is a good plan to remove the rubber dam at once. After this, the filling may be adjusted to the occlusion and made smooth by means of plug finishing burs and small mounted stones. At the last, the finish may be given with flour of pumice and a suitable port-polisher.

104 S. Michigan Ave.

SUGGESTIONS FOR THE IMMEDIATE FUTURE OF FOIL*

By CHARLES SOUTHWELL, D.D.S., Milwaukee, Wisconsin

WHEN, during the early spring, I was invited to join in an effort to return foil to its rightful status in the present practice of dentistry, I could not avoid the feeling that this effort would eventuate in little more than a swan song, and that, if nothing new or constructive was offered, I would find comfort largely in the fact that I had spent my time in the pleasant company of the redoubtables, still active in the field of foil. It was not until after my third serious effort to write that my confidence and courage rose to the point where I felt that I could offer a tentative sketch of a worth-while program—one that might possibly bring about the desired results.

In seeking a reformation of any sort, it is one's duty to become intimate with the underlying facts. Allow me to mention two. As much as I love foil, I admit that it was never exceedingly popular either with the public or the dental profession even in its palmiest days; and speaking reverently, yet frankly, we will be greatly disappointed if we build our hopes too high.

I repeat that foil was never exceedingly popular; not that it was not generally respected and admired and even loved by a few; but that does not spell popularity. Not in 1926. Not in competition with the inlay and the synthetics. Not in these days, when the public greatly prefers to slither in and out of the dental chair in the easiest, quickest and least expensive manner. I advance this as a statistical fact.

Foil has been driven back from the line—routed—more or less crushed and decidedly unorganized. In the olden days, when foil was admittedly the *sine qua non* of dentistry, it was never organized for campaigning because its

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

right to first place had never been challenged; but it surely must be apparent on the face of things that the situation is entirely different today. Therein, we have fundamental fact number two, pointing, as I would have you agree, to the decided need of organization, which I shall come to presently.

Let me return to the ramparts from which we have been so ignominiously driven and about which we have rallied today and be permitted to say, most seriously, that if we can ever hope to regain a footing, it cannot be done by storming—no daylight onrush—no stealing up under a darkened moon, either singly or in squads, but in a perfectly organized body working out a carefully composed program of standardization, which I shall also reach soon and cover sketchily.

I have pictured the few remaining redoubtables at the base of the ramparts, gathered, as I trust they will be at an early day, in earnest discussion of productive measures that shall spell victory as far as we have any real right to expect it.

The chairman of the committee on ways and means, in reporting, may be made to say:

> Your committee, before submitting its formal report, begs leave to turn the searchlight on the ramparts now occupied by the inlay; the synthetics; commercialism and high living, all marching along, arm in arm with the public, to the seductive air of "I need the money" and "Why work so hard?"

And if you will cup your hands to your ears, you will hear the jibes and jeers together with good natured admonitions that "foil is not a practice builder;" "it will take you twenty-five years to get a reputation with foil;" "sell the public what it wants," etc., etc.

The Chairman now turns to his report:

We recommend that:

1. A foil research commission be appointed to standardize the instruments; to standardize the number and kinds of gold; to standardize cavity preparation and technics, to be published in book form, which could be entitled "The Standard Foil Technic."

2. A foil school of modest character be established wherein instructors and demonstrators in the various colleges and practitioners as well may become skilled in the standardized technique. As implied, the equipment need not be either elaborate or expensive, and a matter of five years should suffice for the desired leavening.

3. The forms and kinds of gold be reduced to the minimum required by this standardized technic.

4. The manufacturers of golds be conferred with in support of the issuance only of the forms of gold meeting the requirements of the technic.

5. Study be given to the establishment of the few hand-pressure instruments necessary to the technic.

6. A standardization of the points for use with the hand mallet be accomplished.

7. Study be given to the establishment of a set of automatic mallet points.

8. The same measures be taken regarding points to be used in the Bonwill mechanical mallet.

9. The all-important question or problem of undercuts and the means of locking or seating the first third of a filling be advanced to an exact finality.

10. The equally important question of annealing be given careful study; for it is the belief of your entire committee that much of the discouragement encountered, especially by students, in seating or locking the first third of a filling is due to gross overannealing.

11. The organization of foil study clubs be fostered.

12. Foil propaganda, in pamphlet form, be available at cost to practitioners who desire to reeducate their patients.

13. A humane technic be outlined for the separation of teeth.

14. Definite study be given the proper adjustment of the rubber dam; also a humane adjustment of the clamps and use of ligatures. These important details require the formulation of clear, concise directions.

15. In large restorations, the important question of extension, contact, contour and anatomic occlusion be most definitely and clearly outlined.

16. The management and control of excess gold during the upbuilding be given especial study, to the end that the tax of this detail be reduced to a minimum.

17. In closing this outline of recommendations, we advise that due credit be given to the normal indications for the inlay and synthetics, and that, in clinics and demonstrations, we depart from the more spectacular mesioclusal and distoclusal cavities and confine our efforts to medium and small cavities, leaving large restorations to the reawakened interest in foil.

Friends of foil, you have now before you the report of the hypothetical chairman, and it seems very proper to reveal a decided interest in the outcome. Is it to be merely accepted and placed on file and there remain pigeon-holed? I sincerely hope not.

If these recommendations find merit, and the establishment of a foil research bureau is to receive encouragement at the hands of the American Dental Association, I beg to advise that an entire year will be lost if resolutions are not introduced at this meeting. The shortest time that an official beginning can possibly be made will be one year, for the reason that, under the rules, all resolutions lie over for that period.

Permit me to recount:

Foil was never exceedingly popular.

It is without the makings of popularity.

In contrast with the inlay and synthetics it has grown more unpopular every year.

It has never had a standardized technic.

In its heyday, it jogged along very comfortably without organization.

Today, however, in its struggle for existence, it demands concerted action, which I have designated as organization.

It would appear, therefore, that if foil is to be revivified, it would be well to face the facts—concede the firm entrenchment of the inlay and the synthetics—acknowledge that the odds are tremendously against foil and take prompt steps along the lines indicated.

Going a step farther, I believe that our hope of success lies in the direction of the colleges and with the younger generation. Therefore, at the risk of repetition, I suggest that we, at the outset, would do well to confine our efforts to the rapid accomplishment of small and medium fillings as the proper procedure in the recruiting of our ranks.

Foil cannot be neglected for a matter of ten to twenty years—to sink into a state of lethargy—and then be suddenly prodded into activity.

There was a time, in the history of art, when pigments, carvings, mosaics and marble meant more to the artist than daily bread.—Ruskin.

CROWN AND BRIDGEWORK IN CZECHOSLOVAKIA*

By HUGO GANZ, Prague, Czechoslovakia

THE conditions of dentistry in our country differ from those in your country. In Czechoslovakia, as in the whole of what was formerly Austria-Hungary, dentistry developed as a specialty of medicine, not as an independent art and science as in the United States. Therefore, a dentist had to be a physician who, during the medical course, took a short course in dentistry. The dental standard, especially in prosthetics, was not satisfactory. In the medical course of five years at the university, only one year was given to the study of dentistry, during which the student took part twice a week in dental clinics, in filling and in extracting teeth. A better dental education could have been obtained only in Vienna or foreign countries.

Dentistry, besides being practiced by the dentist-physician, was also practiced by dental mechanics, but illegally.

These conditions have changed since the war. The Czechoslovakian Republic has gained independence. Your hall of Independence in Philadelphia was a witness of the Czech declaration of independence in 1918, and we are proud of the fact that the freedom of our nation was declared at the same place as the freedom of your great nation.

The newly born nation attacked all problems of rebuilding with energy, and immediately made a step towards the founding of modern dental education.

Besides the two dental clinics connected with two universities in Prague, two new university clinics were founded, in Brno and Bratislava, and a special state dental institute in Prague, so that we have five dental school, for 13,000,000 inhabitants.

In 1920, the practice of dental mechanics was stopped by a dental law, which, at the same time, required that a physician have a one year course in the state dental institute in Prague before being allowed to practice as a dental specialist. You will thus understand the rapid progress we have made from an unsatisfactory standard to the more modern dental practice of a younger generation. You Americans, who admire individual progress, can see the great step that we have made within eight short years.

The practice of crown and bridgework, before the war followed the teaching of the schools of Vienna and Berlin. The "Golden Age" of our dentistry before the war is recorded in the number of full shell crowns on the anterior teeth and the bicuspids. You are long past this period, which has continued in our country until now. It was the pride of the public to have

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug, 23, 1926.

something precious in their teeth; and the dentist nurtured this pride.

A lack of understanding regarding dental prophylaxis among the laity led to great destruction in the aproximal parts of the teeth. Decay was removed and fillings, mostly silicate cement, inserted for cosmetic reasons. The cavity preparation was usually unscientific and not in accordance with the standards of Dr. G. V. Black. This resulted in necrosis of the pulp and discoloration, and subsequently, a shell crown was placed.

Only a few advanced dentists used gold inlays extensively, having acquired the skill outside Czechoslovakia. The attitude of dentists in regard to the devitalization of a pulp for prosthetic reasons is evidenced by the fact that it was standard practice to devitalize the teeth before crowning. Therefore, the Richmond crown was commonly used in the esthetic reconstruction of teeth, especially by dentists who wanted to avoid a gold crown as a bridge abutment.

The full crowns faced with porcelain, window crowns and Logan crowns were other types used by the more progressive dentists for better esthetics.

For fixed bridgework, the soldering technic, with platinum pin and Steele's facings, was used, but the technic had not been mastered, and breaking of the facings was the result, so that these methods were soon discredited. The so-called Box system, in which cheap metal teeth were cemented in the cast boxes prepared in the bridge, was also favored. But this system came in use just before and during the war, as employment of the casting process spread more widely in the profession.

The construction of removable bridges was not practiced because demanding too great skill. Bridgework, in the first years of dentistry was introduced for the most part by American dentists. The rank and file of dentists made only rubber partial plates, and the better dentists, gold swaged partial dentures.

THE CHANGE AFTER THE WAR

The war checked all progress and interrupted the exchange of ideas between America and Europe. After the war, some of our progressive men grasped the situation and began the study of American dentistry in order to bring in new ideas.

Dr. Schulz aided greatly in introducing American methods in Czechoslovakian dentistry. Before going to America, he reviewed modern methods of partial denture work in one of his lectures under the title "The Importance of Vitality of the Abutment Teeth," the result of his study of modern American literature. He stressed the importance of the study of the American prosthetics and the interest in American dentistry was stimulated. In 1925, two of our dentists went to America, and they were surprised at the high standards of American prosthetic dentistry.

It is especially due to Dr. Schulz, who studied the best methods in the prosthetic field, that the most recent developments were brought to our knowledge.

In the last three or four years, crown and bridgework has made great progress. More and more dentists are improving in their technic, and it is amazing how fast the demand for better crown and bridgework is growing. It would be unfair to your country not to state the different methods that are practiced

now in our country. The practice of placing full shell crowns on the anterior teeth is decreasing rapidly.

The gold inlay is more commonly used and standard methods of preparation according to the teachings of G. V. Black are practiced extensively. The translation of Dr. Black's "Operative Dentistry," by Dr. Guenner and Dr. Schulz means another step forward.

The indirect technic for inlays improved our practice. A knowledge of the irritation of the supporting tissues of the crowned tooth led us to recognize the limitations of the full shell crown. Gold crowns are not only made as before, as the two piece swaged crowns, but also as cast crowns.

The modern abutments for bridges, such as Carmichel crowns, pinledge crowns made according to Dr. Burgess' technic, and Dr. McBoyle's abutments for posterior teeth are more commonly used among progressive dentists.

The use of the porcelain jacket crown, which demands high-grade work and is practiced only by a few, marks a forward step in dental art. We are greatly obliged to such men as Dr. Elliot, Dr. Hovestadt and Dr. LeGro for teaching us the intricate technic of jacket crowns. A few of our dentists educated in America started early the practice of anchored partial constructions.

The fight between the advocates of the fixed and the removable bridge began in 1923. The books of Dr. Goslee and Dr. Chayes gave impulse for new thinking along these lines.

With the porcelain technic there was introduced Dr. Tinker's method employing root tipped dummies, ensuring greater prophylaxis and esthetic results. In the scientific construction of partial dentures, the work of Dr. Cummer, who gave us the scientific classification of the partial denture, is well known.

In removable bridgework some of our dentists are practicing Dr. Nesbett's, Dr. Roach's and Dr. Akers' technic.

The articles of Dr. Kennedy were closely followed, and brought us new ideas. The technic of Dr. Tench afforded many suggestions. Dr. House's and Dr. Schlosser's technics were adopted for partial dentures. With the more advanced knowledge of articulation came an understanding of reconstruction cases, with occlusion restored by the methods of Dr. Morton and Dr. Little.

All this new knowledge followed the practical application of the study in America of focal infection as regards crown and bridgework. The roentgen ray is an important asset of our dentists, and we avoid devitalization of the pulp in prosthetic cases. We have not wholly accepted the theory of focal infection and we practice root canal work more aseptically, and perform apicoectomy before the use of suspicious abutment teeth for a bridge.

In general, it can be said that the study of American practice brought us new methods; but a dentist in our country encounters this difficulty: Europe has been poor since the war. We have to practice for the most part, the "dentistry of the poor." That is the reason that in Europe in general the high grade of dentistry demanding great skill and expense cannot be developed. It is impossible for the public to pay the required fee. We must practice dentistry that gives service and is cheap and time saving.

In spite of the great differences in our two countries, we are glad that we

can meet our American confréres on the same ground of restoring the health of the public. We appreciate the great service of the American dentistry in raising prosthetic dentistry in our young country to higher standards, and we hope that the links binding our two countries will be stronger as more of our dentists come to America.

DISCUSSION

William D. Tracy, New York City: I regret that I did not have the privilege of perusing Dr. Ganz's paper before its presentation, but have enjoyed very much his report of the status of dental education and the art of dentistry in his country preceding the war as contrasted with present-day conditions. We are glad to note that Dr. Ganz and his dental confréres have found profit and inspiration through their contacts with American postgraduate schools and through our textbooks and literature, and we can only commend the enthusiasm and earnestness of purpose shown by the dentists of Czechoslovakia in improving their dental school, introducing legislation for the regulation of practice and in every way elevating the status of dentistry. The subject of crown and bridgework is a broad one, on which the dental profession is not agreed even now, after years of study and research. There are some who say that there is no place for a fixed bridge in any human mouth, and others who maintain that fixed bridgework, when properly executed, has a wide field of practical application and usefulness. It is my opinion that fixed bridgework has been condemned by many, not because of its use, but because of its abuse. In other words, it is only fair to admit that fixed bridgework that was placed upon diseased abutments and was designed and constructed without regard for, or consideration of, the mechanical, physiologic or biologic problems involved, must necessarily suffer condemnation. On the other hand, many examples of carefully constructed and well-adapted fixed bridgework, which were made with due consideration for all the problems involved, are continually in evidence to bear testimony to the fact that this type of work is justified when used with judgment. Sometimes, the differences of opinion that exist among dentists give rise to heated controversies and, on occasions, even to acrimonious discussion, but as Dr. McGee said in his discussion of Dr. Goslee's presidential address, if it were not for the activities of the energetic but dissatisfied individual, whom we look on sometimes as too radical, the march of progress would be much slower. Therefore, we should recognize the fact that no one of us mortals has all of the truth and should welcome differences of opinion as a stimulant to continued effort and study. We recognize, Dr. Ganz, the difficulties under which you of Czechoslovakia must have labored to correct the unfortunate dental conditions that prevailed in your country immediately after the war, and we are interested in the report of the splendid progress your government and the dental profession have made in meeting the serious problems with which you were confronted. We of America are inspired by the high aims of our fellow practitioners in Czechoslovakia and by your report of the substantial progress already achieved. I feel safe in saying that it is the wish of every man in this audience that you may return to your home country with renewed inspiration and increased ambition to still further pursue your important work.

ESTHETICS AND DENTURE CONSTRUCTION*

By M. M. HOUSE, D.D.S., F.A.C.D., Kansas City, Missouri

ESTHETICS is defined as the theory or philosophy of taste; the science of the beautiful in Nature and art, especially that treating of the expression and appreciation of beauty. Giving this definition a dental application, we may say that dental esthetics consists in the ability to see and appreciate the beauty and harmony of the human face, and to understand the importance of the teeth and bony structures in the production of facial contour and character of expression. To some, this ability may be innate; but to many it is entirely foreign and must be cultivated.

This paper is written with the hope of offering some aid to the latter group. Before we can create artistic dentures, we must be able to see and appreciate the different types of faces and to understand the importance of the various elements entering into the complete harmony of facial form.

The same laws of beauty and design apply in dentistry as in other branches of art. Elementary studies in drawing, painting and sculpture would be invaluable training for one who desires to raise the artistic value of his denture service.

The laws of similarity, contrasts and variety control the selection and arrangement of teeth to obtain the highest artistic results in denture construction; and, in addition, we must apply good mechanical judgment. But this is only a further application of art; for Nature always attains the highest degree of beauty when the mechanical conditions are most favorable. J. Leon Williams made an invaluable contribution to dentistry in his classification of faces into three typal forms and in showing the harmony existing between them and the three typical tooth forms.

In addition, we may classify arch forms into three classes: first, as to size: large, medium, small; and, secondly, as to shape: square, tapering and ovoid. Again, we may classify as to ridge relation, into normal, retrusive and protrusive types, and those with a lateral deviation. As a result of these conditions and their combinations, the anterior and posterior teeth may assume any one of a variety of relations to each other. The anterior teeth may have a normal relation to each other or the lower teeth may be protrusive or retrusive of the upper; and the posterior teeth may have a normal relation or they may present a cross-bite relation on one or both sides. Any one of the typical relations of the anterior teeth may be combined with any of the relations of the posterior. These possibili-

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ties result in a number of typical arrangements of the teeth characteristic of the various types of profiles and face forms which we see. The character and expression is determined largely by the osseous and dental foundation over which the soft tissues are draped. The ridge form and relation must therefore constitute a determining factor in the reproduction of facial character and expression in patients with artificial dentures. This is indeed fortunate; for it is far easier to analyze the mechanical and physical conditions and thus arrive at good esthetics than it is to work with only an artistic purpose in view.

For those of us who cannot readily recognize face form and harmony, such classification is an invaluable aid in working out the proper physical relations, which are essential to the production of esthetic results. It is also the key to proper arrangement of the teeth for best mechanical results. So we see again that mechanics and beauty go hand in hand. In fact, in many cases, when there is difficulty in obtaining pleasing esthetic results, the difficulty will be overcome when the teeth are rearranged so as to produce more favorable mechanical conditions. And this is not strange when we consider that, throughout the whole life of the individual, Nature has been maintaining the highest degree of efficiency and harmony that conditions would permit. Correct mechanical arrangement is also essential in order for the patient to have good speech, and free use of the tongue and cheeks in eating and swallowing. The muscle habits of a life time cannot be materially altered without impairing some of these functions. These established muscle habits may frequently be of the greatest value in determining the degree of opening which we must establish, and in obtaining a correct position and arrangement of the teeth.

When, by study, observation and experience, we have trained ourselves so that we may see and recognize the various types and combinations of face form that patients present, we will then be in a position to undertake the study of the minor details, which are so elusive. It is these details that are so important in restoring the exact expression and character to a face, which is necessary to satisfy the critical eye of patient and family. The ability to see and reproduce these details is the distinguishing quality of a master artist. When the form and outline of the face have been correctly reestablished, we are often disappointed in the expression at the start. This is largely due to the fact that it requires some time for the tissues to adapt themselves to their new positions. It is also necessary for the patients to become so accustomed to the dentures that they are unconscious of their presence, before it is possible for the muscles to assume a state of repose. We may speak of this interval before the natural expression is obtained, as a treatment or developmental period.

The possibilities of the restoration of the form and contour of the face may be largely worked out in the bite plates. Then, the necessity arises of choosing the form and color of tooth that is most suitable to the case. Here, we may have recourse to the studies of Dr. Williams, and, by careful consideration of the face form, select a type of tooth that is most suitable. Differences in arrangement give individuality to the case, and a study of the effect of optical illusion will often aid us in obtaining

the desired results. Arranging the teeth in opposed lines or turning a tooth on its axis is often effective in obtaining artistic effects. In so doing, we may offset the effect of asymmetry and thus strengthen the character of expression. The multitude of possible variations gives free hand to the artist in producing pleasing effects. The color or hue of the teeth must be considered as it is effected by the immediate surroundings. We must study all the properties of light, such as the differences between the color of an object as seen by transmitted or by reflected light. We must consider the contrasts between the color of the tooth and its immediate background.

The texture, form and composition of the tooth play an important part in the color effect produced. Changes of surface, texture and arrangement may modify high lights and shadows so as to give an entirely different appearance.

The character of the color pigment and its distribution in the tooth are of great importance. The translucency and surface glaze of the porcelain also have an effect.

A satisfactory material for use as a gum facing has been our greatest need for many years. Up to the present time, porcelain has been the only material that has possessed anything like a natural appearance. The expense and difficulty of its use make it almost prohibitive. Various substitutes have been offered from time to time, but each of them has had its disadvantages. A number of facing rubbers have been developed. Many of these are fairly satisfactory and have been the most practical material available. They have all been totally lacking in transluency, which has made them very conspicuous in the mouths of many patients.

We are now on the verge of a new era in this regard. There are several very promising bake-o-lite compounds being perfected. Some of these possess physical properties that give the desired color effects. The texture and other physical properties are also very desirable, bake-o-lite having no volume change and good thermal conductivity, and being dense and nonabsorptive. We have used and tested a number of these preparations. In the most nearly ideal, the same material is used for both the base and veneer portions of the denture, thus replacing all the rubber and giving a uniform appearance throughout. It is also suitable for use on metal base dentures. If times does not demonstrate some unsuspected fault, such materials will be ideal for all denture purposes.

ROENTGEN-RAY BURNS*

By C. EDMUND KELLS, D.D.S., New Orleans, Louisiana

THE wonderful x-ray! By its means, the human body can be illuminated and its inmost depths be rendered visible to the human eye. By its means, shadows of the bones, organs and muscles can be cast on a photographic plate, and impressed indelibly thereon for study, and for comparison, for all time.

In critical moments, the life of the patient hangs on the successful use of the ray, which is surely one of the wonders of the age.

ROENTGEN RAY BURNS

What a world of suffering, misery and anguish are conveyed to us by those almost insignificant words—roentgen-ray burns!

The ray was discovered just thirty years ago. Probably no other agent used in surgery, medicine or dentistry, has ever taken so heavy a toll from its pioneers. Suffering, mutilation and death have followed in its wake—all for the sake of progress.

While "Roentgen-Ray Burns" is the title given me for discussion, it was not understood that this paper would be confined to what are commonly known as burns, but rather it was to touch on the several forms in which the harmful effects of the ray become manifest.

The subject, therefore, can well be treated under several captions: 1. Burns of the first and second degree. 2. Burns of the third degree. 3. Delayed burns. 4. Other harmful results.

Burns of First and Second Degree.—Burns of the "first and second degree" as they are called, are not infrequently met with in patients who are under treatment with the ray, but these lesions are amenable to treatment and no harmful results follow.

Burns of Third Degree.—Burns of the "third degree" are of a decidedly serious nature. The erythema is usually to be seen within twenty-four or forty-eight hours,[1] and progress is rapid. Within two or three weeks, the conditions become greatly aggravated.

When this occurs in the case of a patient, naturally the exposures are discontinued, and remedial agencies are put to work at once. Some cases yield to topical treatment (that is, to the use of ointments and lotions); others do not. When all other treatments fail, the skin graft can be fallen back on, and when skilfully done I believe is usually, or at least very frequently, a success.

When it is the operator who is thus affected, it becomes a different story. Few operators, I fear, have had the

*Read before the Section on Exodontia, Anesthesia and Roentgenology, Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

1. MacKee, G. M.: X-Rays and Radium in the Treatment of Diseases of the Skin, Philadelphia, Lee & Febiger, 1921.

good judgment to give up their work when the bad effects therefrom become manifest in themselves. On the contrary, as a rule, they have continued on, contrary to their judgment, each in the blind hope that a miracle would happen in his individual case, and that he would escape the fate of others.

This hope has always proved in vain; no miracle ever happened, and they have proceeded onward to their doom.

The case of Dr. Walter M. Dodd[2] is typical. He began experimental work at the Massachusetts General Hospital in October, 1896. Within one month, a dermatitis resembling an acute sunburn developed on his hands. He continued his roentgen-ray work.

At the end of eighteen months, acute painful ulcers appeared on both hands. These were excised (in July, 1898) by Dr. Porter, and skin grafts used, which were successful. This was the first case, on record, of the use of the grafts in such a case, and the operation was suggested by Dr. Dodd himself.

No sooner had these lesions healed than the trouble developed in other places, and, during the next few years, he was subjected to one operation after another. Bit by bit, his fingers were taken away, skin grafts being used between times in a vain attempt to save them. The axillary glands were removed. Fortunately for him, he was "called" before his hands were amputated.

In 1915, as roentgenologist of the First Harvard Medical Unit, he went to France, where, because of his unusual skill and unbounded natural resources, he became invaluable. On returning to this country, for a while his general condition appeared greatly improved, but suddenly his lungs were attacked by the disease and the end soon came. Dr. Dodd died on December 18, 1916.

Thus we see that, for twenty years, he carried on his work in the face of the greatest suffering and peril, during which time he was operated on more than eighty times. The price of his devotion to his work was his life.

Many of the early workers experienced the same fate. I myself was well acquainted with Fuchs, Cassabian, Green, Bauer, Caldwell and others. I went to see them on my vacation trips. Every one of these, after a few years of agonizing experiences, were mercifully called to their reward.

So much for the prompt appearing burns. Now let us turn our attention to class 3, or delayed burns.

Delayed Burns.—In classes 1 and 2, it must be noted that the ill effects produced by the ray are rather prompt in their manifestation. In the character of lesions now under consideration, they do not manifest themselves for months or even years.

In a paper on this subject, Dr. Rudolph Matas cites two cases.[3] In the one case, a young lady, 25 years old, came in for treatment for a "typical advanced exophthalmic goiter." She was subjected to a series of irradiations, given "serially, at intervals of months between the exposures, for three years. The treatments were always stopped when the characteristic erythema appeared." By this time, that is, at the end of the three years of treatment, to

2. Macy, John: Walter James Dodd. A Biographical Sketch, Boston, Houghton & Mifflin Company, 1918.

3. Matas, Rudolph: Delayed or Remote Appearance of X-Ray Burns After Long Periods of Latency, Tr. Am. Surg. Assoc., 1923, pp. 462-467.

all intents and purposes a cure had been effected. This patient remained well for four years, "when the skin on the neck became thickened and infiltrated and patches of gangrenous dermatitis appeared."

The patient went from bad to worse, and, for three years, was in a very serious condition. Finally she improved, and the involved area was excised and covered with skin grafts. Recovery ensued, and there has been no recurrence of this trouble.

In this same paper, Dr. Matas cites a second case, in which the gangrenous dermatitis did not appear for three years. This patient was operated on for an advanced carcinoma of the breast with axillary metastases, in 1903. After an uneventful recovery, "prophylactic roentgenotheraphy (unscreened) of the whole field of the operation was instituted in series, which continued at intervals for three years. The patient then remained well for another three years, when suddenly a gangrenous dermatitis appeared." This case did not yield to treatment. An epidermoid carcinoma developed, and finally the patient died.

PRESENT DAY IMMUNITY

Dr. Amedee Granger reports more than 80,000 exposures (for pictures only) during the past seven years in his Charity Hospital clinic, without a burn. His patients ranged in age from the new born babe to those over 80 years old.

Drs. Samuel and Bowie (New Orleans) believe that, with the present knowledge of its dangers and the means to take care of these dangers, burns of the third degree never should result from the use of the ray.

Dr. B. C. Cushway (Chicago) writes me: "X-ray burns with the present equipment are inexcusable. They can only happen as a result of carelessness on the part of the technician or physician."

PLAYING WITH FIRE

Notwithstanding the fact that patients should not be burned, even today when the ray is used for treatment of cancer and other troubles, very occasionally a patient is burned. And these unfortunate results sometimes occur among the cases of our best operators. Therefore, to my mind, and basing my opinion upon what I have seen, the roentgenologist of today is verily "playing with fire."

OTHER HARMFUL RESULTS

To go back a little: William J. Morton, M.D., was one of the earliest experimenters with the ray. Before the expiration of the year 1896, he and Edwin W. Hammer, an electrical engineer, published a small book, "The X-Ray or Photography of the Invisible." There is only one paragraph in the whole book that is of interest to us at this late day, but that one is of the greatest interest. It reads:

> In all practical work with the x-ray, it is necessary to have a standard of intensity which will serve as a guide both as to where to work and how long. This standard will have to be set up by each operator for himself. For instance, he will soon learn to recognize a standard clearness and brilliancy of the picture of the bones of his own hand and forearm, as the case may be.

It was not necessary for Dr. Morton to issue those instructions, because no operator, I believe, ever started his machine for the first time without throwing up his hand between the tube and the fluoroscope for his first exhibition of the ray. It was the most natural thing in the world to do. I did that the moment my tube became excited for

the first time, and that was long before the publication of Dr. Morton's book.

No one, at the time, could possibly forsee the disasters that would surely follow the occasional but continual exposure of one's hand to the ray. There was no possible way of discovering it. In some cases, it took several years; in others, my own, for example, there were no really harmful results visible for twelve years. There were keratoses at the end of the ninth year, but they were not serious.

The harmful results which followed these exposures and which were latent for a period of from five to twelve years, in different operators, manifested themselves in various ways as (1) keratoses; (2) dermatitis; (3) ulcerative dermatitis; (4) carcinoma, and (5) glandular involvement.

Keratoses.—These lesions, I believe, usually proved to be harmless (they did in my own case). Many operators kept them down by the use of files or sandpaper. At times, radium was used, causing them to disappear temporarily at least. Sometimes they would break down and ulcers would follow.

Dermatitis.—Dermatitis of a mild degree would often occur, and usually it would yield to treatment.

Ulcerative Dermatitis.—When the stage of acute ulcerative dermatitis was reached, the prognosis was always most unfavorable. As far as I can learn, the skin graft had to be relied on, and when this failed, as frequently it would, amputation followed.

A correspondent who undoubtedly does suffer from his exposures to the ray (long since discontinued), reports that "mercirex" affords him more relief than any other remedy that he has used, and he has tried many. Blisters form on his hands and the skin "cracks," as he terms it.

It might be well to say here that anyone interested in this subject should read "Sequelae of Radiation Therapy" by A. F. Tyler,[4] which was read at the Denver X-Ray, Radium and Physiotherapy Meeting, Feb. 21, 1924.

Carcinoma.—While the roentgen rays have a wonderful therapeutic value and under some conditions do check the growth of, or destroy, neoplasms, particularly carcinoma, unfortunately, *most unfortunately*, at other times they disrupt the cells of normal tissue and cause the very disease they are supposed to cure.

Under the conditions now being considered, the worst of the ill effects of the ray are produced. Here is the history of one of the oldest radiodontists of the day. He began the use of the ray in 1901, and the first effects were shown before the end of the year. From that date to this, more than 100 operations have been performed on him, each in a desperate effort to defer the fatal day. The axillary and epitroclear glands were removed. At this writing he is "carrying on" as usual.

As a result of his wonderful bulldog tenacity and the skill of his attending surgeons, notwithstanding these hundred operations, he has both hands and parts of some fingers left. Let us pray that a kindly Providence will yet take compassion on him, estrange him from surgery and allow him to continue the work he loves and end his days in peace of mind, as well as of body.

In the case of another roentgenologist, the bad effects were not felt for nine years, and then, during the next

4. Tyler, A. F.: J. Radiol., 5:266 (Aug.) 1924.

thirteen years, five operations were performed, three fingers being amputated and the axillary glands removed. Seven years have now passed since the last operation was performed and there has been no recurrence of the trouble. As far as I know, this man is in a class by himself, because he appears to have reached the "safety zone."

Other cases give the same painful history. Operation succeeds operation, in vain attempts to save the hands, but in the end they are sacrificed.

Radium and, in some instances, the ultraviolet ray were tried with varied results.

I have the records of two other cases, the results in which, thus far, have been most unfortunate. After years of suffering and futile operations, each of these well-known roentgenologists has lost a hand; so again I say, let us pray that their troubles are ended, for they are also still "carrying on." With nerves of steel and hearts of gold, they gladden the lives of all with whom they come in contact. F. H. Baetjer, Thomas A. Groover and G. A. Day, maimed as they are, are still on the "firing line."

The question naturally becomes, "How can these tissue changes progress so slowly that it requires years (from three to twelve according to my reports) for them to become manifest?"

According to Dr. Karl Grassmann[5] of Munich, Professor Duerck made a most thorough study of these excised tissues and proved conclusively that

> . . . the underlying pathology of these long-delayed and necrogenic x-ray burns is a progressive proliferative endarteritis which obliterates the arterioles of the derm and subdermal connective tissue, leading to a gradual but fatal ischemia and nutritional disturbance in the radiated field. Whether this endarterial obliteration is initiated primarily in the endothelium of the arterioles and capillaries or is secondary to correlated changes in the perivascular connective tissue is not fully determined, but the fact remains that the mystery of this long period of latency is explained by the slow but progressive obliteration of the vessels which continues indefinitely once the endothelial proliferation has been started by the penetration of the rays.

These are the conclusions reached by Professor Duerck, and I assume that they are accepted by the profession at large.

THE DENTAL ASPECT

Thus far, I have presented the case only as it has applied to the general roentgenologist and his patients. Let us turn to the dental aspect of the use of the ray.

During the thirty years of my use of the ray, I have, fortunately, never met with a serious result in a patient. Once, when I was taking two radiograms of a lower molar, a slight erythema of the exposed side of the face, neck and arm followed, which gave me quite a scare. However, this disappeared promptly, and, according to Pfahler,[1] it was not caused by the ray at all, but by an electrostatic discharge.

In three other cases, the exposures were followed by a slight loss of the hair, which was not serious as its loss was replaced by a new growth.

It may be due to the fact that our dental colleagues do not unnecessarily advertise their troubles, but thus far I have seen no record of any untoward results in the patient following the use of the ray for dental purposes, and diligent inquiry among the manufacturers of dental apparatus has failed to uncover a single case, other than the four I have reported.

5. Grassmann, Karl: Deutsch. Ztschr. f. Chir., 179: 115, 1923.

Nor have I been able to learn of any dentist who has suffered to a serious extent from the use of the ray—other than my own unfortunate self. Let us hope that there are none.

One dentist reported that he had been burned by the ray and his hands had never gotten over the effects though he gave up the use of the ray. From his description of his case, I am led to believe that his trouble was not due to the ray, but rather to some chemical—procain, metol, formaldehyd or something of that nature. He obtains relief, in a measure, from the use of witch hazel and glycerin.

The conditions under which I began my experimental use of the ray were particularly unfortunate. The early tubes were very unstable and had to be constantly reset, which meant *the hand before the tube* every time that one was used. Again, I was fascinated by the work and took scores of unnecessary pictures. Rats, mice, fish, eels, crabs, etc., were particularly fascinating subjects.

Then again, with the Tesla coil, sometimes I could obtain better results than could be obtained by other operators with their machines in use in the hospitals, in those early days, and so I was called on to take all kinds of body pictures for surgeons.[6]

Thus, it was that my exposures were infinitely more numerous than were called for by my daily dental practice, and owing to the disastrous results that have followed, I feel it my duty to give a history of my case, as a warning to others.

I began work with the ray in the spring of 1896. At the end of ten years, some keratoses were visible and my hands looked a little different from normal—that was all. About the twelfth year, an ulcer about the size of a dime appeared on the back of my left hand. This was cut out, and as there was plenty of loose skin available, it was drawn over the wound and sutured, and the parts were soon back to normal.

During the ensuing fourteen years, ten or twelve ulcers appeared from time to time, or, sometimes, instead of mere ulcerative dermatitis, they were epidermoid carcinomas, without any break in the skin. These all yielded to simple surgical procedure, or radium therapy, with the exception of one, in which case a skin graft was successfully made.

At this juncture, and just as another "ulcer" had appeared on a finger on the left hand, there came on the scene a well known advocate of the ultraviolet ray, as produced by a quartz tube. He looked at my hands—both of them—and said. "The application of the ultraviolet ray will positively cure this ulcer; and not only that, it will clear up all these keratoses." And then he said: "In this ulcer on your hand, there are bacteria that are breaking down the tissues and there are regenerate living cells." Is that clear? *Bacteria that are destroying the tissues and also regenerate living cells.* "In addition to its many remarkable qualities, ultraviolet radiation displays a 'selective' characteristic that enables it to destroy bacteria and at the same time regenerate living cells. Now then, give these hands of yours a course of treatment, exposing them to the ultraviolet ray (but bear in mind that it must be the ray generated by the air cooled lamp and not by the water

6. Kells, C. E.: Thirty Years Experience in the Field of Radiography, J.A.D.A., 13:693 (June) 1926.

cooled lamp), three times a week for from four to six weeks, and not only will this ulcer and all these keratoses be cured, but that bad spot on your right thumb will disappear; and that's not the least of it either. After this treatment, you will never again have any trouble with your hands as far as these old x-ray exposures are concerned. I know what we have accomplished in the past."

Can you imagine what a ray of hope was given me by these statements?

The treatment by the ultraviolet ray was at once instituted and carried on for four weeks. During these weeks, the most agonizing pain was experienced. This ray was and is supposed to relieve pain, but in this instance it certainly did aggravate it. At the end of the fourth week, the hands were in a worse condition than at the beginning, and so the treatment was discontinued.

To cut a long story short, let me say that immediately after the ultraviolet ray treatment was finished, another carcinoma started on my hand, grew rapidly and was excised. Besides this, the finger with the ulcer, that was to have been cured by the ultraviolet ray, went from bad to worse. Surgery; skin graft; pinch graft—all failed. The finger was sacrificed in order to save my life. Then followed months and years of the most sorrowful experiences. Skin grafts, surgery and radium—fifteen operations since the ultraviolet ray treatment—the left axillary glands removed, a 5-inch skin graft on the forearm, the left thumb gone, and then Fate—struggled against for so many years—was triumphant: amputation.

To summarize: During fourteen years, I had occasional troubles, and every one yielded to mild surgery or radium. Then the ultraviolet ray was used, and immediately my condition grew a hundred-fold, a thousand-fold, worse. What are the natural conclusions? There can be only one conclusion, and that is that the ultraviolet ray, as applied to my hand, must have activated the dormant pathologic cells instead of killing them, and all these unfortunate results followed.[7] Beware of the ultraviolet ray.

INCITAMIN

On reading Dr. Matas' paper[8] I determined to try incitamin on one of these painful places on my right thumb, which had failed to be benefited by the use of radium or the ultraviolet ray. I did so, and this bad spot became practically well.

NORMAL SALIVA

About a year later, this spot flared up again, and in short order looked and felt very bad. Then the thought occurred to me: "If the saliva of a Danish horse (because that's what incitamin is) cured this spot a year go, why wouldn't my own fresh saliva be as good if not better than his? Why not try it? Don't the dog and other animals treat and cure their wounds with their tongues?"

Try it I did, and I can assure you that my own fresh saliva appeared to have all of the virtues of incitamin, for the thumb improved rapidly under this treatment and soon was almost normal, but never quite so.

Saliva is used in two ways. In the one, I just suck my thumb upon all permissible occasions during the day. At night, I soak a small gauze pad with saliva, put it over the lesion, cover it

7. Kells, C. E.: Dent. Items Int., July, 1926.

with a piece of rubber dam and then apply a bandage. That keeps the parts soaking wet all night.

During the past two years I have used this saliva frequently upon ulcerative surfaces on my left hand, and it has frequently cleared them up.

As regards incitamin and normal saliva, after using these for three or four years, I came to the following conclusions:

1. It must be appreciated that I had several kinds of trouble on my hands, and scores of bad ulcerative spots cleared up under the use of radium, incitamin and saliva and the dyes, and amputation only followed carcinoma that would not yield to other treatment.

2. Incitamin certainly did cure the spot on the right thumb which failed to yield to radium, the ultraviolet ray and other remedies.

3. Normal saliva certainly has produced remarkable results, and I see no reason why it should not be as efficient as incitamin.

4. I can see no hope for radium, incitamin or anything but the knife when a real carcinoma is involved.[7]

DYES

At times, I have used dyes on these spots, which would undoubtedly help them. Following is the formula:

Crystal violet	1 part
Brilliant green	1 part
Fifty per cent alcohol	98 parts

NEGATIVE ELECTRONS[8]

Drs. Donald C. Butts and J. W. Frank of Philadelphia evolved a new theory about cancerous growths, and experimented along its line. A tabloid statement of their experiments and findings would read something like this:

Normal cells, in normal healthy tissue, are "neutral," electrically speaking. The cells in these neoplasms under consideration have been proved by reliable (?) experimentations to be positively charged, and that explains the activity of the cells.

When a beam of roentgen ray is passed through a mass of, say, parawax, the roentgen rays pass on through the parawax, but a world of beta rays and "scattered radiation" are given off at all angles from this beam and in all directions through the parawax.

Beta rays, which are not rays at all, but merely negatively charged electrons, are thus given off in quantities at a right angle to the original beam of roentgen-rays.

If a hand like mine, for example, that contains some of these neoplasms that are built up with positively charged cells were held against a block of parawax and the *hand only* covered by a sheet of lead, and then a beam of roentgen rays was shot down through the parawax, the beta rays or negative electrons thus generated would penetrate the hand, and, negatively charged as they are, would neutralize the positive condition of the cells of the diseased tissue.

This was "as I heard it." Seeking for any possible help, I went to Philadelphia to see Dr. Butts and Dr. Frank, and they received me most cordially. On examining my hand, Dr. Frank said that he felt assured that the treatment would benefit me. The treatment was tried, but, unfortunately, my thumb not only did not improve but grew rapidly worse, and three weeks from the date of the first treatment, it

8. Butts, D. C. A.: New York M. J., 118:89 (July 18) 1923. J. Radiol., April and June, 1924. Hanemannian Monthly, December, 1924 and February, 1925.

was so bad that amputation became necessary.

THE RADIO KNIFE

About a year ago, one of these small ulcers appeared on the back of a finger. It could not readily be excised without using a skin graft, and conditions were not so favorable for grafting.

A salesman happened along at that moment and induced us to try his "radio knife." With this knife, the ulcer was eliminated, and while healing progressed rather slowly, it reached a satisfactory end. That was the only time the radio knife was used on me. The spot remained cured *to the end.*

THE GLANDS

In a case of carcinoma of the hand, the epitrochlear and axillary glands are very apt to become involved, whereupon they need to be removed, or, rather, they should be removed in advance of their becoming involved, more especially the axillary glands.

While I believe these are looked on by some as rather simple operations, I doubt that the victims themselves ever entertain that view.

One of my correspondents had the glands in the axilla removed and by one of the very best surgeons in the country. Infection followed and he had a very serious time for about six weeks. My experience leads me to believe that this operation is no light affair. Two years have now elapsed since my own were removed, and the arm and shoulder and wall of the chest have not yet returned to normal and are painful and uncomfortable always.

CONCLUSIONS

1. While it is claimed by those who should know that the dangers of causing roentgen ray burns of the third degree are limited to the incompetent or careless operator, I believe that, when it comes to radiotherapy, even today, the operators are, as I said before, playing with fire.

2. It is absolutely impossible for any dentist to produce roentgen-ray burns on a patient if he limits his exposures to the erythematous dose as given by Raper.[9]

3. Any dentist who exposes his hands to the effects of the ray by holding films in the mouth is courting disaster of the worst kind. Beware of that practice, I implore you!

9. Raper, H. R.: Radiodontia, New York, Dental Items of Interest Publishing Company, 1923.

DENTAL EDUCATION AND THE PHILIPPINE DENTIST*

By ELADIO R. ALDECOA, Manila, P. I.

IT is not my object to give you a comprehensive treatise on dental education, for this subject has been thoroughly covered by several learned scholars in both continents. I wish to discuss briefly a few facts well known to you which perhaps have not been considered seriously in the light of certain accepted principles in dental education.

*Read before the Section on History, Science and Libraries at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

QUALIFICATIONS OF A DENTIST

It has been truthfully said that "dentistry is practically the only profession that requires for its successful practice the skill of a surgeon, the heart of a physician, the artistic sense of an artist, the patience of a scientist and the genius of a mechanic;" which means that those who have chosen dentistry as their profession must possess these qualities; and, in order to determine who are qualified, entrance tests to detect these qualifications should be required. This will tend to reduce the large number of dentists who are not dentists in the true sense of the word. The same can be said of the other professions—there are some quack physicians, there are petty fogging lawyers, etc. The alluring title of "Dr." and the selfish desire "to get rich quick" are driving many young men and women to study dentistry as a means to an end. Disqualified by lack of proper training and professional attitude, they are a disgrace to the profession and a danger to public health; and they waste time, money and energy which could have been very well devoted to something more profitable.

To remedy the situation, the curriculum has been strengthened by adding more medical subjects and a predental course. Some countries have gone so far as to require a medical education as a prerequisite to dentistry, making the latter a specialty of medicine. There is no doubt that this move is intended to elevate the scientific standing of the dentist, but it in no way provides for the selection of those who are properly qualified. On the other hand, it sets a barrier against these deserving young men who do not have the inclination to be physicians and cannot afford to stay so long in college. Not only that; in the last analysis, it places dentistry in a higher category than medicine, but the former falls under the dominion of the latter, under the circumstances losing its distinct individuality as a profession; and, to say the least, it is not in accordance with the history and traditions of the best dentistry in the world—American dentistry.

DENTISTS IN MEDICAL FACULTIES

It is encouraging to find dentists made members of medical departments, teaching the fundamental science of medicine to dental students. It is to be regretted that only a few colleges have adopted this policy, and the great majority rely on the medical and liberal arts instructors to teach such important subjects as anatomy, physics, chemistry, physiology and pathology. The reason for this is purely economic. This seemingly satisfactory practice has produced a class of students who have accumulated fundamental facts and principles in medicine, but when the opportunity to practice dentistry arises, they do not know the whys and wherefores of the subject, because the relations of the above mentioned subjects to dentistry were not thoroughly explained and emphasized.

PRINCIPLES OF DENTAL EDUCATION

Professor William Guy, dean of the Edinburgh Dental College, at the meeting of the International Dental Federation, August, 1924, enunciated the principle of dental education which I believe to be the goal to which all dental educators lead their students. He said:

> The eye, the hand and the mind must be taught to see, to work and to think in unison; this is the underlying principle of dental education and putting this principle into practice is the problem of dental pedagogics . . . . It means education of the individual to such a point that, whatever his mind, founded upon accurate observations, scientific knowl-

edge, and experience conceived to be the best procedure in any given condition, his hand can perform with surety. Unless the work of his hand is governed by the working of his brain, his labor is in vain.

Whatever technic is required, it should be demonstrated and correlated with scientific facts and principles. Whatever operation the students perform, they must be required to explain the basic scientific principle that supports it; and the instructor must always require it, especially in clinical practice. Unless this is done, it will be difficult for the students to comprehend the scientific character of dentistry and its place among the other scientific professions.

THE DEVELOPMENT OF DENTISTRY IN THE PHILIPPINES AND THE STRUGGLE OF THE PHILIPPINO DENTIST FOR HIGHER EDUCATION

Quoting from "The Practice of Dentistry in the Philippines," by Dr. G.A. Gramon, read before the National Dental Association of the Philippine Islands, the following is the picture of dentistry in the past:

> There has never been any record about the practice of dentistry in the Philippines. While there are evidences that would point to the fact that dentistry has been practiced in the Islands since time immemorial much as it was practiced in other places during the ancient ages, the only reliable data we possess regarding its ancient practice here date only as far back as 1870 A. D. In or about that year, two French dentists found their way to Manila, where they immediately engaged in practice. Their work then consisted mainly in making artificial dentures and extracting loose teeth or badly broken-down roots, with crude turnkeys, instruments which have evolved into the forceps and elevators of the present days . . . It was therefore very lucky that one of these two men who practiced in Manila, M. Fertri by name, admitted Jose Arevalo into apprenticeship. Jose Arevalo, who was also a sculptor and artist of some renown, soon made himself proficient in his new trade and eventually became the first Philippine dental practitioner. He attracted a great deal of attention on account of a full set of upper and lower dentures which he carved out of ivory . . . He passed his craft on to members of his family who practiced contemporaneously with two Spaniards . . . . Although Black's famous technic for cavity preparation, and Johnson's method of making gold fillings, have already been given to the world, our first dental practitioners, in doing such work, depended solely on their natural skill and artistic instinct. It is remarkable, however, that, handicapped though they were by lack of modern apparatus and instruments, these first dental practitioners in the Philippines could have performed work which would bear favorable comparison with some modern achievements.

Such were the conditions obtaining before the American occupation. Anybody who wished to practice dentistry could do so through apprenticeship and self-education.

But when the Americans came to the Islands, the practice of dentistry was standardized. One American dentist who interested himself in establishing dental education in the Philippines was Dr. Louis Ottofy. He organized the first state dental school of the University of the Philippines and became the first director of the same. His idea of dental clinics for school children is now being actively carried out by the Junior Red Cross dentists, under the auspices of the American Red Cross in the Philippines. There are seventy-one dentists employed to take care of all the school children in nearly all the provinces. Other Americans who helped in arousing enthusiasm among the Philippine dentists were members of the United States Army Dental Corps, Col. Siebert Boak, Col. Robert Mills and their associates. In 1924, the National Dental Association of the Philippine Islands invited them to present clinics, and every year since then they have given clinics at the annual conventions held under the auspices

of this society. It is the influence of American dentistry which has caused young Filipinos to study dentistry in the United States. When these young men came back to the Islands, they brought with them American ideas and established dental schools patterned after American methods, which are recognized to be the standard.

At the present time, there are four dental schools, one of which belongs to the state, while the rest are private. There is one among the latter that is exclusively for girls. The names of these in the order of their foundation are: the Philippine Dental College, the School of Dentistry of the University of the Philippines (government institution), National University College of Dentistry, and College of Dentistry for Girls, which is affiliated with the centro Escolar de Senoritas.

In justice to Spain and her glories in the past, it might be said in passing that, after the organization of the civil government and prior to the opening of any of the above mentioned schools, the University of Santo Tomas, which is 11 years older than Harvard, introduced some dental subjects for two semesters in the courses for Cirujano Ministrants, which is equivalent to the training of the nurse at the present time. Those who took the course were allowed to take the dental board examination, created by the first dental law, enacted in 1903, regulating the practice of dentistry in the Philippines. Thirteen years have elapsed. It was generally conceded that this law was defective, for thereafter another bill was approved requiring a high school education for entrance to the technical three year course leading to the degree of doctor of dental surgery. Realizing that the new law was not in accordance with the standard of dental education at that time, in 1924 the National Dental Association of the Philippine Islands, with the support of the majority of the dental colleges, after many failures, succeeded in having this law amended by the legislature, making the course four years instead of three. But contrary to the expectation of the people, especially those who appreciated the scholastic, scientific and medical attainment of the governor general, the bill was vetoed. Thus, the will of the people and the eight years of hard labor and sacrifice by those who sincerely believe in the high standard of dental education, was defeated. But the determination of the Philippine dentist to keep pace with the progress of education, which is backed up the Philippine Legislature, was not killed. Last year, the same bill, with certain improvements, was again introduced, and was passed by the Senate. It will probably be considered by the Lower House this session.

As we believe our cause is just and is intended solely for the betterment of the profession, and ultimately for a more efficient dental service, we are convinced that, in spite of these difficulties, we must continue fighting for a higher standard of dental education. We believe that we are right. And we hope that the sympathy of the dental world is with us, and whatever influence this Congress may exert in favor of our struggle to establish a system of higher dental education in the Philippines will be highly appreciated as another valuable contribution to the cause of better dentistry. And, indeed, not only the Philippine dentists but the whole people will be grateful for whatever you may do toward the realization of our plan, the adoption of a four year course in dentistry.

SOME ETHICAL PHASES OF PRACTICE*

By J. LOWE YOUNG, D.D.S., New York City

WHILE it is true that no two persons are exactly alike, or work exactly alike, or use the same appliances in exactly the same way, or employ an identical technic in adjustment of appliances, or arrive at the same conclusions when diagnosing cases, it would seem that the fundamental principles of ethical problems should be so phrased that they would serve as a guide for everyone.

It would be egotistical for me to expect to draft regulations that would meet all requirements and be acceptable to every one, but by free and frank discussion, and fair criticism of what is to follow, honestly striving for our mutual benefit, we should be able to arrive at a method of procedure that will be acceptable to all. We are impressed that this subject is of vital interest to the younger men in the profession, but there should not be a different standard for them from that for those who are well established in practice.

As a specialist in dentistry, the orthodontist naturally expects patients to be referred to him from various sources, such as the dentist, the physician, other orthodontists and the satisfied patient. It is therefore desirable to discuss this question under the following headings: our relation with (1) the dentist, (2) the physician, (3) the orthodontist, and (4) former patients; and (5) our duty to the patient.

RELATION WITH THE DENTIST

The conscientious dentist who is conducting a family practice, and who desires to refer a patient to an orthodontist, should either send a card of introduction with the patient or notify the orthodontist that he has referred the patient to him. The orthodontist should always send a note or card of acknowledgement to the dentist who has shown sufficient confidence in him to refer a patient to him. The orthodontist should carefully examine the teeth and their investing tissues to ascertain whether there are any cavities that require filling, or inflammatory conditions needing treatment, and when such are found he should confer with the dentist and insist that such cavities be filled before appliances are adjusted on the teeth, and that the investing tissues be restored to a state of health. This is necessary for his own protection, as well as for the welfare of the patient.

It should never be assumed, when a dentist refers a patient to an orthodontist, that he has included the whole family. The dentist has a right to see that the treatment and general handling of the patient meets with his expectations. This is particularly applicable where it is the first patient referred by him to this orthodontist. If the parent

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

should ask that a second child be examined, it is quite proper to examine the teeth in a casual way, but the orthodontist should be noncommittal until he has talked with the family dentist.

Prior to the discussion of treatment with the parent, it is advisable that accurate models of the dental arches, a full set of dental radiograms and photographs of the face be procured. The orthodontist is entitled to a fee for these services, if, for any reason, the patient is not treated, and if it is so stated at the beginning, misunderstanding and disagreement are obviated. In fact, such a procedure has been found to inspire confidence.

If the dentist desires that the patient return to him from time to time, so that he may observe the condition of the child's mouth, the orthodontist should cooperate with him in every way. He should be pleased that the dentist is interested in the welfare of his patient. If the orthodontist's adjustment of appliances is what it should be, he will have no cause for alarm, provided he has instructed the patient properly in, and insisted on his properly carrying out, home prophylaxis. When the patient fails in this, the orthodontist is justified in removing his appliances and dismissing the case. Before taking this step, it would seem advisable that a conference be arranged with the parent, the patient and the dentist.

Wherever cavities occur in the teeth of a patient under orthodontic treatment, he should be sent at once to the dentist who referred him to the orthodontist. Just how to proceed in such cases is rather a delicate question. Obviously, it is not desirable to offend the dentist. If he has a hygienist in his employ who treats the child every few weeks, it is considered good practice to write him a note to the effect that when this patient comes in for prophylactic care, the teeth should be examined for cavities. If he does not employ a hygienist, but carefully looks after his patients by frequent inspection, it is advisable to communicate with him and ascertain when he is to see such a patient. Just previous to this visit, the appliances should be removed (not the bands, if they are securely cemented), so that he may not be hampered in his examination of the teeth. If he is known to be a dentist that sees his patients only when they are in trouble, it is advisable to mark on a chart just where the carious areas are and send this either to the dentist or to the parent of the patient. If to the latter, it is advisable to keep a carbon copy of the chart sent, bearing the date of the examination.

Some dentists prefer that marked charts be sent showing where the carious areas are, giving as a reason that it saves their time in not having to examine all the teeth. It should be the dentist's duty to explore carefully for cavities even if a marked chart is sent, for it is his obligation to fill all carious places. The orthodontist, for his own protection and the welfare of his patient, must see to it that the teeth and their investing tissues are not allowed to suffer during the time the patient is under his care.

As many cases of malocclusion are under observation and treatment for several years, it sometimes occurs that a patient becomes dissatisfied with the dentist who referred the patient. In such cases, the orthodontist is never justified in referring the patient to another dentist, without permission from the one who referred the case to him. This becomes a delicate question and should

be handled in as delicate and diplomatic a manner as possible. It is difficult to outline a definite procedure in such emergencies. Each case should be managed in the best possible manner so as not to give offense. While it is true that every professional man should strive to so conduct his practice that his clients are pleased with his efforts, it is equally true that no professional man should want to retain clients who have become dissatisfied. This applies equally to the general practitioner and the specialist.

RELATION WITH OTHER ORTHODONTISTS

It is not to be supposed that the orthodontist can please all patients referred to him or all patients under treatment. To do this, one would have to be superhuman. Then what shall be the method of procedure when a patient who has been under treatment by another orthodontist or dentist asks an opinion?

Before discussing this question in detail, we wish to state emphatically that the word of a patient should never be taken as evidence against a fellow practitioner. Regardless of how honest and upright the patient may be, when a disagreement arises between patient and professional man, the patient is liable to get the wrong point of view, and not state all the facts in the case. Besides, there are two sides to every controversy, and it is manifestly unfair to consider only the patient's statements.

I have made it a practice, whenever a patient or parent becomes dissatisfied with my efforts, to relinquish the case and to remove all appliances from the mouth. The patient is then free to consult some one else, and the dentist consulted is in no way hampered as to how he shall proceed. I have also thought it advisable to give to the dissatisfied patient the original models, radiograms and photographs, so that the dentist who is to continue the case will be in possession of all the data that will enable him to best serve the patient. Objections have been raised by several orthodontists to this method of procedure, the reason being given that, for their own protection in case of suit by the dissatisfied patient, they wished to retain the original models and all the data in the case. I would advise that, in such emergencies, the original models be duplicated, and the duplicate set be given to the patient. As the radiograms are taken in duplicate, one set can be spared, and as the negatives from which the photographs are printed are on file, the photographs can be spared. In this connection, it may be stated that in over twenty-one years' exclusive practice of orthodontics, I have never been called on to defend a suit with a dissatisfied patient.

Whenever a patient comes in for an opinion, and examination of the mouth reveals appliances on the teeth, the patient, if a minor, is at once dismissed from the room and the parent informed that, under the circumstances, the case cannot be discussed in the absence of the dentist having the case under treatment. The parent may say, "I just want you to tell me what you think of the work being done in my child's mouth." The answer to this should be that it is absolutely unfair to all concerned to discuss the case or express an opinion of another's efforts without possessing all the facts, and that, in no event, will the case, the appliances or efforts of another be discussed in his absence.

Strict adherence to the foregoing is advisable, regardless of how well the

appliances are adjusted or how well the case may appear, from a casual examination, for the reason that whatever is said may be misquoted or misunderstood. If the parent expresses a desire for consultation, he should be told that a conference must be arranged with the dentist treating the patient, who should bring with him all the data on the case. Obviously, this conference should be held in the office of the dentist consulted.

The patient should be present so that a thorough examination of the mouth can be made with all the data at hand after the dentist who has had the case under treatment has been permitted to express his views. Then, and then only, is one justified in examining the patient of another. If it is found that the case is progressing in a satisfactory manner, the parent should be advised to that effect. If it is considered that, for the patient's welfare, some changes should be made in the method of treatment or adjustment of appliances or faulty technic, one should not hesitate to state his views to the dentist in charge of the case. As a rule it is better that this be done after the patient and parent have been dismissed. A fee should be charged for such services to the patient or the parent. Under no circumstances should such a patient be accepted by the dentist consulted.

When it is found that the dentist in charge of the patient is incompetent and grossly careless in his technic, so that injury to the teeth of the patient is liable to result, it becomes a delicate problem. The patient's welfare should be the first consideration. It is manifestly unfair to accept a consultation fee and not give service in return. The parent is entitled to know the true facts, even though the feelings of the dentist in charge of the case are wounded. In some instances, it may be possible to advise him so that he may continue the treatment without detriment to the patient. In other cases, it may become necessary to state to the parent that the dentist in charge is incompetent, and to advise that treatment be discontinued. Such a patient should not be accepted by the dentist consulted except on written request of the dentist who had charge of the case.

Again, if a parent should state "I have finished with the other man," he should be advised to return the patient to the dentist in the case and to tell him frankly that it is desired that treatment be discontinued and appliances removed. This he should do, if he cannot convince the parent that the case is progressing in a proper manner, provided all financial obligations have been settled. Then one should be free to accept such a patient.

If the parent refuses to take the patient back to the dentist treating the case and still desires to place the child in the care of the one consulted, the procedure should be as follows: If the parent will give the name of the orthodontist who has had the child under treatment, an effort will be made to see whether satisfactory arrangements can be made for the case to be continued. If this request is refused, I dismiss the patient with the feeling that all concerned have been dealt fairly with.

You will observe that no attempt was made until the last to ascertain the name of the dentist who had the patient in charge. The reason for this is that if the patient is to return to him, it is just as well not to know the name of the one having the case under treatment. In the event that the parent is willing to give the name of the dentist,

a conference should be arranged with him so that you may get his views. If he has the welfare of the patient at heart and cannot get along with him, he should be willing to relinquish the case. In many such cases, it will be found that the case is undesirable.

When a patient is to be temporarily removed so as to render it impracticable for him to present himself at regular intervals, he should be referred to some one who is competent to look after his case. In such cases, it is imperative that a letter be written stating just what one would like to have done for his patient. Then the one to whom the case is referred has no responsibility other than carrying out instructions given and his fees should be arranged accordingly. The patient should be told that he must pay the dentist rendering such service directly.

Many a patient requiring further treatment has been referred by one orthodontist to another in a distant city, and, according to the statement of the parent, the entire fee has been paid for the completion of the work, and he has been given to understand that there will be no further expense to him for the completion of the work. In the absence of any communication regarding the patient, and this is usually the case, the parent's word should not be taken as final. A letter should be written to the dentist who referred the patient, asking him for all the data, and inquiring as to whether the entire fee has been paid. If the first orthodontist confirms the statements of the parent the second orthodontist should be at liberty to decline to accept such a patient. It is not fair nor ethical to expect another to render services for which he is not remunerated.

If the patient is to sojourn in a locality where no intelligent cooperation can be obtained, the appliances should be removed and the case be placed under temporary retention for the period of time the patient is to be absent. It should be considered grossly negligent and unethical to permit a patient who has bands and appliances on his teeth to go for several months without proper care. It is advisable, before beginning a case, to outline carefully the treatment necessary, to estimate about how long it will take to accomplish the result and to state definitely what is expected of the patient during the period of treatment. The ignorance of many otherwise intelligent people in such matters is surprising.

It should be considered unethical for an orthodontist to begin a case and give a fee for the completion of it when he knows in advance that the patient is to move permanently to a distant city shortly after the appliances are placed, and that the case must be continued by another. In such cases, it is only proper and just to refer the patient without adjusting appliances.

When a patient under treatment makes a permanent change of residence so that the case cannot be continued by the dentist who began the work, the patient should be referred to some one who can continue the treatment. In such cases, it is advisable that all data be sent to the one to whom the case is referred and that a letter be sent stating all the facts in the case, saying that he is at liberty to change the appliances and method of treatment if he so desires and that he is to be responsible for the completion of the case. After a copy of this letter has been sent to the parent, the responsibility of the dentist who began the treatment is terminated. The one to whom the patient is referred should be at

liberty to state his fee for the completion of the case or to refuse to take the patient.

RELATION WITH THE PHYSICIAN

As the practice of orthodontia is becoming better founded and also better understood, physicians have become more interested and are much more liable to refer patients than in former years. All that has been deemed necessary when a physician refers a case is to send him a note or card letting him know that the patient had come in and thanking him for his confidence. If the case is one of unusual character, it would be well to refer the patient back to his former dentist so that he may be enlightened as to the possibilities of orthodontics. In such cases, the orthodontist is at liberty to refer such a patient to a dentist if the parent so desires.

RELATION WITH FORMER PATIENTS

Whenever a patient is referred by a former patient, a note of acknowledgement should be sent, expressing the pleasure in his confidence.

DUTY TO THE PATIENT

In all professional work, the welfare of the patient should be uppermost in our minds and this applies more to the specialist in orthodontics than possibly to any other branch of the dental profession at the present time.

The specialty of orthodontia is but a few decades old, and it behooves each and every one of us to be most conscientious in serving our clients, so as not to lower the high standard that was set for us in the beginning of the specialty. We all know that it is an exacting practice, and it is only by paying attention to the minutest details and conscientiously striving to establish, as nearly as possible, the normal arrangement of teeth that we, as specialists, can hope to maintain this standard.

Specialists are consulted because they have had special training along certain lines which should enable them to render services not obtainable from the general practitioner. Parents who have put their children in the hands of the specialist have a right to expect expert, honest and conscientious treatment, with nothing essential to the welfare of their children left undone.

DISCUSSION

Lloyd S. Lourie, Chicago, Ill.: The successful treatment of orthodontic cases requires the cooperation of all parties concerned and the formulation of basic rules of procedure for them is most desirable. We are indebted to Dr. Young for taking the initiative in this matter, knowing, as he did, the difficulties of satisfying all interests. He has succeeded in making a number of ethical rules to which there should be no objection and he has made valuable suggestions of courtesy and policy, in the conduct of orthodontic practice. For the sake of brevity, let it be understood that I agree with those parts of the paper which I do not discuss. Dr. Young states quite correctly that "In all professional work, the welfare of the patient should be uppermost in our minds," but, unfortunately, in his list of topics for discussion, "Our duty to the patient" is placed last, and, in some of his methods for dealing with controversial or embarrassing situations, the interest of the patient seems to be crowded out or even preceded by business policy and professional courtesy. Endeavoring to keep the patient's interests in the foreground, let us consider some of these problems. Under "Relation with the dentist," Dr. Young says, "It should never be assumed, when a dentist refers a patient to an orthodontist, that he has included the whole family. The dentist has a perfect right to see that the treatment and the general handling of the patient meets with his expectations. This is particularly applicable when it is the first case referred by him. If the parent should ask that a second child be examined, it is quite proper to examine the teeth in a casual way, but the

orthodontist should be very noncommittal until he has talked with the family dentist." This places the orthodontist in a position secondary to that of the dentist when he should be first, and also implies that the orthodontist's first responsibility is to the referring dentist rather than to the patient, an idea with which I cannot concur. If the dentist wishes to make reservations in referring a patient, these reservations should be made to the patient himself or to the parent, who has the right to know whether there is any limitation of confidence in the orthodontist. But if the orthodontist is asked by the parent to examine another member of the family, he should do so, not casually and noncommittally but thoroughly, giving his best advice. Dr. Young feels that when cavities occur in the teeth of a patient under orthodontic treatment, a delicate question arises as to how the dentist shall be notified without offending him, and suggests some roundabout ways of doing this. I see no reason for the dentist to take offense at directness in such a situation. The patient should be instructed to arrange with him at once for the necessary fillings. The marked charts do save time and misunderstanding. Then we are told that if a patient becomes dissatisfied with the dentist that referred the patient the orthodontist is never justified in referring the patient to another dentist, without permission from the one who referred the case to him. This is too strong an assertion, as the patient's interests and the success of the orthodontic treatment might depend on the orthodontist assisting the patient in selecting a competent dentist. Here is a conflict between the welfare of the patient and business policy. I have been cowardly enough to avoid the responsibility in most cases, but I feel that a better plan would be to assist the patient and notify the dentist. Under "Relation with the orthodontist," the statement is made that "In no event will the case, the appliances or the efforts of another be discussed in his absence." I agree that advice regarding another orthodontist's case under treatment should not be given without first having his explanations and case history, but there seem to be several reasons why it is not always necessary or advisable that he be present when the opinion is given. The first reason is that the patient is more liable to be given an unbiased opinion, or at least he will feel that this is so. In addition, should there be a difference of opinion, the other orthodontist might be saved the embarrassment of criticism in the presence of other persons. Furthermore, he might find it inconvenient or impossible to be present, particularly if his practice is in another city. If he has not been present, it would be courteous to let him know the advice given the patient. Concerning the subject of consultations with other orthodontists, we are told that under no circumstances should such a patient be accepted by the one consulted. This would be a safe rule by which the one consulted might protect himself from the suspicion of unfair criticism for his own benefit, but it might cause injustice to the patient. For instance, the dentist consulted might be the only other orthodontist in the community, and the patient must either continue with a man whose work is unsatisfactory, or discontinue treatment. Even if there were other available orthodontists, the one consulted should be at liberty to decide whether or not the patient's welfare requires that he take the case. I agree with Dr. Young that when it is found that the dentist in charge of the patient is incompetent and grossly careless in his technic, so that injury to the teeth of the patient is liable to result, the parent is entitled to know the true facts, even though the feelings of the dentist in charge are wounded, but I do not agree that it necessary to have a written request from such an incompetent or neglectful orthodontist, before accepting the patient for treatment. When a dissatisfied patient comes in for continuation of treatment, it is advisable, as Dr. Young says, to attempt to reconcile him and his orthodontist, if it appears that the treatment is not at fault, or if it is possible to give advice that would enable the other dentist to continue the work, but, failing in this, I think that it is not necessary to ask permission of the other orthodontist before accepting the patient. It would be preferable that the patient return to the first orthodontist for removal of appliances, but, in some cases of serious controversy, it would be embarrassing for both of them and should not be insisted on. Whenever a consultation is given concerning a patient under treatment by another orthodontist, as to whether he is to be taken for treatment or not, models should be made showing the condition at the time the opinion is given.

Harold Chapman, London, England: Few men, if any, have had a longer or wider experience in the exclusive practice of orthodontia than has Dr. Young, and none could have had fewer difficulties of an ethical nature with parent and patients. I have read this paper a number of times in the more critical spirit, and each time that I suspected a particular point had been overlooked, I found it there when I read it again; nor does the paper contain any statements with which I would disagree except in minor details. Dr. Young has very cleverly included in his paper every difficult situation that may arise. Points worthy of emphasis are: 1. Parents should be informed previously to a consultation that a fee is charged for it. 2. Cavities should be filled and gums made healthy before treatment is begun. 3. Regular examination by the dentist for cavities, etc., is imperative. 4. Home prophylaxis should be insisted on. 5. The word of the patient is not to be accepted without confirmation. 6. When patients leave one orthodontist for another, all records should be transferred. 7. Before a case is begun, patients should be informed about: (a) duration of treatment; (b) number of visits; (c) fees. The orthodontist taking over the case should be given a free hand; this fact should be expressed and not simply implied. Orthodontists and dentists, when they transfer patients, are extremely neglectful to pass on information regarding the case; more often than not, such patients come without any record at all, and the dentist taking over the case has to rely entirely on what the patient tells him; whereas, he should know every detail if he is to continue the treatment to the best advantage. Again, the situation is difficult when such a patient is wearing appliances which undoubtedly are harmful and which could be replaced by others to the great advantage of the patient. I have been perplexed a number of times by such cases, and, though one writes to the dentist who referred the case, frequently he gets no reply. The rule that patients wearing appliances and seeking an opinion should not be seen except in the presence of the orthodontist who has the case in charge seems to me to need a little modification if one is to be just to all parties. As in the last case, so in this one, the solution would be easier if the two orthodontists met; but frequently distance alone is sufficient to make this improbable if not impossible, and the matter has to be discussed through correspondence. The resulting delay may make it impossible for the patient to be seen again. It seems to me that, in such circumstances, the one consulted should examine the case thoroughly so that a report may be made; if the report is entirely satisfactory, I see no reason why patient or parent should not know at once; if not entirely favorable, then it may be desirable to communicate with the original orthodontist, first informing him of what one intends to report to the patient, at the same time requesting him to give his views and comments first. The duration of treatment is a difficult matter to estimate. It has been my custom to tell parents that the case will take so long and cost so much. It happens in a number of cases that the length of treatment is considerably greater than I estimated (I seldom say less than three years), and, under the circumstances, the fee should be increased. Would Dr. Young tell us how he deals with this difficulty? Does he tend to overestimate the time factor and the fee, or does he make some provision as regards further fees after the expiration of the estimated time? If one gives an estimate as regards time and fee, and the time is exceeded, the parent does not think that any additional fee should be payable and if, under those circumstances, an additional fee is charged, one may be accused of deliberately prolonging a case for the sake of the increased fee. I feel that Dr. Young can give some very helpful information in this connection. Another point of difficulty or rather source of embarrassment arises when the parent transfers the patient from the dentist who referred the case, to another dentist, without mentioning the fact, and the orthodontist only learns of this by accident at some later period. I would ask Dr. Young how he would advise that the referring or original dentist be informed that the orthodontist has played no part in the change in plans. I fully endorse what Dr. Young says in regard to thanking, by letter, the dentist and the physician who has referred a case, but when a parent has done this, I usually wait until I see him and express my thanks personally. Dr. Young spoke of home prophylaxis. To discuss this is beyond our purview, but if Dr. Young would say a few words on how this is carried out, all here would appreciate his remarks. It is admittedly a difficult question.

Some children come in with their appliances as clean as when they were placed; in other cases, we are baffled as to how the appliances can become so unhygienic. When I report by letter to the parent on the number of visits, fee, etc. (as is my practice), I take the opportunity to do propaganda work, which includes a statement that early treatment, efficient mastication and correct breathing are invaluable aids to obtaining a good result. I also send a leaflet giving instructions on diet in relation to dental caries. I look on this part of my report as of general value to the community and one which it is a duty that we, as a profession, should carry out when suitable opportunity presents. I was about to say that Dr. Young has presented a valuable paper, but I regard it as invaluable. It is a code of ethics for the conduct of an orthodontic practice. Every orthodontist will find in it helpful advice in the varying circumstances which may arise, and no one starting in practice can afford to omit a careful study of this paper before he undertakes his first case, storing in his mind those rules which are so clearly set out in it.

PATHOLOGY OF THE MOUTH AND SURGICAL PRINCIPLES GOVERNING ITS REMOVAL*

By WILLIAM L. SHEARER, B.A., M.D., D.D.S., F.A.C.S., Omaha, Nebraska

I SHALL take up some of the surgical principles incident to the removal of teeth, plus the removal of infections of investing tissues. Great advancement in most fields of surgery has taken place, but from the standpoint of surgery of the mouth, generally speaking, there is room for better training and refined technic, if we are to serve our clientele and avoid some of the many complications that can be placed at the door of poor surgery. If our patients are to be better served, we must have more men trained for this field of service.

We need not, I think, discuss the clinical and bacteriologic phase of infections of the mouth or their sequelae. The literature is replete with wonderfully fine scientific research work.

We can say that individuals carrying pulpless teeth, especially the type that it is difficult, if not impossible, to diagnose from radiographic evidence, are playing with their future health on borrowed capital. The general complaint of the patient may not be traced to so small a cause, and his years shortened by lack of knowledge on the part of the physician and the dentist who have his health in their care. It is truly unfortunate that the diseases of the mouth are not associated with more local pain. That the changes in the vestibular apparatus are so remotely associated with the true cause is often the reason for overlooking mouth infections as its primary or contributing cause. Such secondary lesions as those of the blood vessels, heart and kidney are too often not properly associated with a focus of infection.

The important thing for us to consider, then, is the management of morbid processes of the jaws, to standardize our technic, to be certain that all in-

*Read before the American Society of Oral Surgeons and Exodontists, Louisville, Ky., Sept. 18-19, 1925.

fection is removed, as far as is possible with surgery.

We now come to the discussion of different operations, indications and contraindications. It should be understood that, in showing these drawings of different designs of operations, I am only illustrating principles: each case is a case and should be handled as such.

Alveolectomy, either full or partial, is poorly understood by most men in the practice of dentistry and surgery of the mouth. It is indicated in nearly all cases where there is much infection. The extent of the removal of process should be determined by the operator. When the diseased areas are removed, he can do the amount of process trimming which, in his judgment, is indicated. To do properly almost any kind of surgery, one must see what he is doing, and the careful reflection of the mucoperiosteum enables one to remove infected areas under the eye. If alveolectomy of the upper jaw is performed, he need never break into the maxillary sinus, which is so commonly done in blind curettement of infectious root ends of teeth whose root tips are in close proximity to the mucous membrane. It is not always easy to remove all of the infected tissue even when access is good.

Drawings illustrative of alveolectomy, which are only diagrammatic of what is done, are misleading, and men who undertake surgery with limited training may be easily misled. Anyone who is practicing surgery of any part of the body should have had training under a competent man. To learn surgery from books and drawings is never the best method, and is most unfortunate for the patient who falls into the hands of such men.

The members of the allied specialties of medicine are awakening to the fact that better management of the morbid processes of the jaws is necessary. It certainly is the task of the specialist of dentistry to devise means of successfully treating these conditions of the jaws. Unfortunate as the loss of certain or all the teeth may be, it is entirely justified when combating such foci, which can be considered in no other sense than a menace to the health. Not enough serious thought has been given to mouth pathology. Not enough thought has been given to surgical principles dealing with certain pathologic problems of the mouth. The surgical technic has been sadly neglected. Too much operating has been and is being done without a sufficient knowledge of the pathologic process present. Too often the pathologic condition is not overcome, and as a consequence, if recovery followed, it was in spite of us and not because of us. As a result, many have discredited the true relationship of mouth infection because of the unhappy results. Great good will result from our cooperative work when we better understand the pathology of the mouth, and better and more thorough surgical principles are employed. It has been my privilege to observe both the clinical and the operative end results in a large series of cases representing the various systemic manifestations with which mouth infections seem to be associated. When we consider critically the end results of the old operative procedures, we are convinced that they have failed in their objective. We have been content, heretofore, with the mere extraction of diseased teeth. The inefficiency of this procedure, I think, has been definitely proved. Radiograms taken some time after the usual methods

of extraction had been employed disclosed unmistakable evidence of failure in our efforts to overcome disease. Remaining osteomyelitic areas, granulomas, etc., have been definitely shown in several cases when all the teeth had been removed ten, fifteen or even twenty-five years previously. These were proved at operation. Furthermore, the systemic reactions following these procedures, especially when the extractions had been numerous, and curettement extensive, were at times alarming, as shown by the case cited by Billings and others. The tooth sockets drained for days and weeks with a foul discharge, which oozed from the reddened, inflamed gums and responded slowly to treatment. In addition to the local disturbance, systemic reactions frequently occurred, manifested by chills, fever and lassitude, which would last for days. Increase in the leukocyte count was common. It required months for the alveolar process to become smooth enough for the comfortable wearing of a plate.

These failures and complications can be easily explained when we appreciate that, in treating chronic dento-alveolar abscesses and their contiguous diseased areas, we are dealing with chronic osteomyelitis of the jaw bone and that the major portion of the pathologic process is in the bone and not in the tooth. As I have said many times in former papers, mere extraction disregards the fundamental principles of bone surgery. We know well that bone surgery demands the removal of dead bone and granulomas and collapse of the bone cavity as far as possible. We cannot assert too strongly that the end results of an operation and the realization of the desired results by the physician and patient depend on the certainty with which the entire pathologic condition is overcome. Failure on our part to remove completely the pathologic area promises just as uncertain results as when the laryngologist fails to remove completely the diseased tonsil which has been acting as a focus of infection. The responsibility incident to cooperative medicine and surgery must be given more serious thought in the light of many of our failures.

THE EVENTUAL DENTAL CURRICULUM*

By HENRY L. BANZHAF, D.D.S., F.A.C.D., Milwaukee, Wisconsin

THE past decade has been marked, on the part of the public by an increasing interest in dentistry. One of the most striking manifestations of this interest is the constant improvement in the teaching methods and facilities of the educational institutions that have in their charge the education of the dentist. The most satisfactory thing about this improvement is that it is but a beginning—that the immediate future holds even greater advancements in store.

Dental educators everywhere in this country are engaged in a conscientious self-inspection, and there is hardly a school that is not planning some pronounced improvement. Earnest experimentation in courses and curriculums is already far advanced. The future of dentistry and dental education is indeed bright.

I feel that my subject, "The Eventual Dental Curriculum," is a most timely one. At present, there are those among dental educators who see only chaos and confusion in the present diversity of opinion as to what constitutes the best dental curriculum. They deprecate the fact that dental teachers are not all of one mind on this question, and pessimistically interpret this as a sign of confusion and retrogression. Some even have allowed themselves to become facetious in recounting the number and variety of the various plans for dental curriculums. These men forget that progress is possible only when a difference of opinion exists. They apparently do not realize that the greater the diversity of opinion, the more thorough and intense will be the resultant educational research, and hence the more conclusive the final results.

Allow me, particularly for the benefit of our colleagues from other lands, to recite briefly the various plans for dental education that have been advanced in our country. Afterwards, I shall point out which of these plans is growing in favor and some of the logical and common-sense reasons for this situation, after which I shall conclude my discussion with an account of my experience with this plan and give reasons for my confident belief that, in it, we have the eventual dental curriculum, at least for the American continent. I am not conversant enough with recent conditions among institutions of learning in other countries to give any opinion whatever as to what might be the best plan for those institutions. Perhaps even for those who are our honored guests on this occasion, my discussion may prove suggestive.

In our country, at present, we have had suggested eight distinct plans for dental education:

*Read before the Section on Dental Education at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

1. The plan advanced by Dean Guy S. Millberry of the University of California in January, 1925, in which he proposes (*a*) a four-year course comparable to the four year dental course that has been given in the past, based on high school graduation and leading to the degree of bachelor of science and followed by an optional fifth year of graduate instruction in orthodontia, prosthodontia or some other specialty leading to the degree of master of science; or (*b*) a five-year course following two years of prescribed liberal arts work leading successively to the degrees of bachelor of science (following the fifth year of college work), master of science (following the sixth year of college work), and doctor of dental surgery (following the seventh year of college work). Thus, he suggests a division of the dental profession into highly educated possessors of the dental degree and less educated dentists who have completed what he terms the technical course leading to the bachelor's degree.

2. The plan in which the present dental course would be improved and extended to five years, teaching dental courses in each of the five years but placing no particular emphasis on courses taken for their cultural value alone. This curriculum leads to the degree of doctor of dental surgery only.

3. The plan in which liberal arts courses and dental courses are given during five years, the courses being so arranged that each group will extend over the period of five years. This plan would give the graduate both the degrees of bachelor of science and that of doctor of dental surgery.

4. The plan in which a four-year course in dentistry follows one year of prescribed liberal arts college work. This course leads to the degree of doctor of dental surgery. The standards of most universities will not allow the conferring of the bachelor's degree in addition.

5. The plan in which a four-year course follows two years of prescribed liberal arts college work leading to the degrees of bachelor of science and doctor of dental surgery.

6. The plan that would abolish the degree of doctor of dental surgery entirely and would eventually require all persons who treat the mouth and teeth to be possessors of the medical degree, with additional training in dentistry.

7. The plan calling for two years of liberal arts college work, followed by two years of medical work, and two years of dental work leading to the degrees of bachelor of science and doctor of dental surgery.

8. The plan in which a three-year dental course is preceded by two years of prescribed liberal arts college work and followed by one year of optional graduate work. The completion of this curriculum without the graduate year would give the student the degrees of bachelor of science and doctor of dental surgery, and the completion of a graduate year would give the student the additional degree of master of science.

All of these plans, with the exception of the last, the two-three-graduate plan, are the result of a desire by the respective proponents either to follow the plan of medical education as closely as possible or to make as few changes in the old four-year course as possible. They are, in my opinion, conceived in a spirit that is either too radical or too conservative.

In a short paper it is impossible to discuss all of those plans in any more than a brief way, but such a discussion, even though it be limited, is necessary if we are to arrive at a logical conclusion.

The first plan mentioned, namely, that advanced by Dr. Millberry, has received little support except in California, perhaps largely for the reason, that, if it is adopted, it will split the dental profession into two groups. I desire to say this much in commendation of this plan: it takes due cognizance of the need of graduate courses in dentistry.

The second plan mentioned, namely, the idea of offering a curriculum of professional work only in which dentistry is taught for each of the five years, has received some support, particularly in Canada. Much can be said in favor of this plan. Its great defect is that it will not produce such broadly educated dentists as will several of the other plans. It is to be preferred, in my opinion, to the plan, advocated by certain schools, of giving a five-year course in which liberal arts courses and dental courses are placed side by side in each of the five years. The five-year professional course will at least make a dentist who is well trained in procedures relating to dentistry even though his general cultural education may be neglected; but the five-year mixed liberal arts and professional course will make neither a well-trained nor a broadly educated dentist. How much attention will a junior or senior dental student give to a purely cultural course, such as philosophy or language, unless he is driven to it? The idea of mixing the professional work with the cultural courses is, obviously, pedagogically unsound. I should like to take more time to discuss these five-year plans more thoroughly, but lack of time prevents. I desire to point out that neither course gives due recognition or encouragement to graduate instruction; the advocates of neither course have ever emphasized the importance of graduate work.

The greatest defects in the one-four plan, the plan calling for four years of professional training following one year of liberal arts college work, are, as I have pointed out in previous papers on this subject, (1) that the period of college preparation is neither long enough nor thorough enough, and (2) that the plan offers no encouragement to graduate work, because a bachelor's degree would not ordinarily be given, and, therefore, courses leading to graduate degrees could not be given without the loss of a year in time. As far as the content of the courses in a curriculum built on the one-four plan is concerned, it has no advantages that are not also possessed by either the five-year plan or the two-three graduate plan. In previous writings on this subject, I have proved this particular statement so conclusively that, to my knowledge, no advocate of the one-four plan has ever attempted to controvert it.

The two-four plan and its companion, the two-two-two plan, each have the advantage of providing a sufficient time for preparation for the professional work. Both have the disadvantage of making no provision and offering no encouragement for graduate work. A student who has spent six years acquiring two undergraduate degrees cannot be expected to return for a graduate year; and thus the greatest benefit that these longer courses would bring to the dental profession and to

the public would be lost. The greatest need of the dental profession at this time is more scientific research, more intelligent investigation, and, for this reason, work of graduate grade should be encouraged.

Another defect of these six-year undergraduate plans, if generally adopted, is that they will not meet the increasing demand for dental services. To increase the undergraduate dental course from three years in 1916 to six years in 1926 is, in the opinion of most dental educators, too radical a step. Lack of time prevents a full discussion of this defect. I am, prepared to admit that this defect will not be pronounced as long as the six-year course is not generally adopted by many schools.

If the advocates of the two-four plan or the two-two-two plan have in mind eventually to incorporate dentistry with medicine, and are, for that reason, constructing a curriculum as much like the medical curriculum as possible, I believe that they are, perhaps unwittingly, doing a great harm to the cause of dentistry. On page 77 of the Report of the President of the Carnegie Foundation for the Advancement of Teaching for 1925, there appear two statements that are worthy of constant repetition at all meetings of dentists and dental educators. The first is: "The unusual mechanical and esthetic demands upon dentistry have fully justified and continue to require its active development as a separately organized profession." The second: "The long continued indifference of medicine to the abnormalities and diseases of the teeth and oral tissues suggests that if dentistry were called stomatology and added to medicine, oral health service would continue to be neglected by the medical profession."

And finally, we have the two-three-graduate plan, which has the virtues of all of these plans with none of its defects. It is just as thorough as any thus far presented, since it provides for six years of instruction, one year of which is of graduate quality. The student is prepared thoroughly for his professional work by reason of his two years in the liberal arts college; he could not have secured this training in but one preliminary year. The student may enter the practice of dentistry at the end of five years, thus meeting the public demand for more better trained dentists. He is encouraged to remain for an additional year of graduate instruction because, by so doing, he may earn the degree of master of science. The student's attention is directed exclusively (1) to preparation for professional courses, (2) to the professional courses in dentistry, and (3) to research work or work of graduate grade.

My personal experience with the two-three-graduate plan dates back to 1921, when, under the rules of the Dental Educational Council of America, a number of students who presented two years of prescribed liberal arts college work were admitted as sophomores in our four-year course. These men graduated in three years. The satisfactory experience that I had with this group of students, which was one of the factors that prompted me to give the plan a thorough test in the school with which I am connected, is given in detail in the proceedings of the American Association of Dental Schools for 1925, and reprinted in the *Dental Digest* for August, 1925. My experience with the two-three-graduate plan proper dates from last fall (1925). A more or less detailed statement concern-

ing some of the more important matters relating to the curriculum that was adopted, together with a short account of its administration and the record of the students that were enrolled during the past year, will not be out of place at this time for the reason that they all point to the conclusion that, in this plan, and I am certain of this statement, we have a solution of our problems.

In 1925, Marquette University adopted the following curriculum. We have not found it necessary to make any important changes for 1926.

Outline of Five Year Dental Course

Freshman Year

First Semester	Clock Hr.	Sem. Hr.	Second Semester	Clock Hr.	Sem. Hr.
Inorganic chemistry 1	119	4	Inorganic chemistry 2	119	4
Botany 1	119	4	Zoology 1	119	4
English 1	51	3	English 2	51	3
Technical drawing 1	68	2	Public speaking 1 and 2	34	2
Mathematics 1	51	3	Mathematics 2	51	3
Gymnasium	34	0	Gymnasium	34	0
	442	16		442	16

Sophomore Year

Organic chemistry 8	119	4	Organic chemistry 9	119	4
Physics 1	119	4	Physics 2	119	4
Language	68	4	Language	68	4
Psychology	51	3	Ethics	51	3
Elective	17	1	Elective	17	1
	374	16		374	16

Pre-Junior Year

Prosthetic technic 101	64	2	Prosthetic technic 102	144	3
Dental anatomy 101	144	3	Operative technic 102	144	3
Dental metallurgy 124	48	2	Histology 112	144	5
Anatomy 110	288	9	Bacteriology 108	144	5
Materia medica 112	64	2	Materia medica 113	32	2
	608	18		608	18

Junior Year

Clinic 102	160	2	Clinic 103	240	3
Crown and bridge 103	240	5	Prosthetic technic 104	112	3
Operative dentistry 103	32	2	Preventive dentistry 101	32	1
Dental histology 113	48	2	Pathology 114	160	5
Physiology 110	160	5	Physiologic chem. 125	48	2
Principles of surgery and exodontia 109	32	2	Anesthesia 110	16	1
			Physical diagnosis 112	16	1
			Radiology 114	16	1
	672	18	Dental pathology and therapeutics 101	32	1
				672	18

Senior Year

	Clock Hr.	Sem. Hr.
Clinic 105	528	8
Clinical pathology 115	64	3
Operative dentistry 104	32	2
Oral surgery 111	32	2
Prosthetic dent. 105	32	2
Thesis	----	1
	688	18

	Clock Hr.	Sem. Hr.
Clinic 106	544	9
Orthodontia 101	48	2
Economics 120	16	1
Oral surgery 112	32	2
Jurisprudence 120	16	1
Preventive dent. 102	32	2
Thesis	----	1
	688	18

A few brief statements concerning this undergraduate curriculum may be of interest. The curriculum has been criticized because we have purposely included no technical nor strictly dental courses in the first two years. In reply to this criticism, I desire to state that, in the opinion of our faculty, such courses would defeat the very object of the preparatory years. The inclusion of courses in dental anatomy or prosthetic technics would only serve to divert the attention of the student because he would place a false value on them, and thus the beneficial effects of his purely preparatory courses would be minimized. We have not included courses of the nature of manual training for the reason that, while such courses would be valuable, there are so many other courses in science, mathematics, philosophy, foreign language or literature that are of infinitely greater value to the dentist and we therefore hesitate to eliminate them. Our modern American youth, with his astonishing technical knowledge of the home-made radio, farm machinery and the collegiate automobile, which requires a major repair for every mile that it runs, may be depended on to possess sufficient mechanical skill to complete a dental course of three years preceded by a good foundation of two years of liberal arts study.

While this course, if taken in its entirety at Marquette University, is given exactly as I have outlined it, we admit students as prejuniors or first year dental students when they present credentials from recognized colleges or universities that cover the following courses:

Inorganic chemistry	8	semester hours
Organic chemistry	4	semester hours
Biology or zoology	8	semester hours
English	6	semester hours
Physics	8	semester hours
Electives	26	semester hours
Total	60	semester hours

Last fall, we admitted as prejuniors a bachelor of arts from Providence College who had completed three years of his course at Holy Cross College, and a bachelor of arts from Stanford University, as well as students from Carroll College, DePaul University, the University of Illinois and the College of the City of Detroit. None happened to be admitted from the College of Liberal Arts of Marquette University, although we expect twelve students from this source this fall and fifty in 1927. We accepted no students on condition. Unless they possessed all of the required courses, without exception, they were advised to enter the college of liberal arts for further preparation. We also refused to accept a number of students who complied with

all of the requirements as to courses but who did not present as many honor points as semester hour credits. In other words, these students had secured only an average of less than C, or fair, and hence were not eligible for admission. We have found that the two-three-graduate plan not only attracts students but also interests them tremendously after they begin their studies. We expect an enrollment of thirty prejuniors this fall, and seventy the year following.

After the five years of undergraduate instruction, the student is encouraged to take an additional year of graduate instruction, for which he may earn the degree of master of science. Up to the present time, we have organized but four graduate curriculums, although others may be planned as the need develops. These four curriculums give opportunity for research and specialization in orthodontia, oral surgery, preventive dentistry or prosthetic dentistry.

Graduate Curriculums

Graduate Curriculum in Orthodontia

Courses	Clock Hr.	Sem. Hr.
Radiology	64	1
Anatomy-histology, embryology, head and neck	152	4
Physiology and dietetics	306	8
General and special pathology	90	2
Surgical pathology and principles of surgery	80	1
Orthodontics	436	10
Gnathostatics and photostatics	72	2
Thesis	-----	4
	1,200	32

Graduate Curriculum in Oral Surgery

Anatomy—head and neck	286	8
Histology	135	4
Embryology	108	3
General and special pathology	90	2
Bacteriology and sero-immunology	164	4
Major and minor oral surgery	209	4
Surgical pathology and principles of surgery	80	1
Anesthesia	64	1
Radiology	64	1
Thesis	-----	4
	1,200	32

Graduate Curriculum in Prosthetic Dentistry

Embryology	50	1
Physiology and dietetics	306	8
General and special pathology	90	2
Histopathology	210	4
Bacteriology and sero-immunology	164	4
Orthodontics	32	1
Prosthetic restorations	220	4
Principles and mechanics of occlusion	128	4
Thesis	-----	4
	1,200	32

Graduate Curriculum in Preventive Dentistry

Embryology	50	1
Physiology and dietetics	306	8
General and special pathology	90	2
Histopathology	210	4
Bacteriology and sero-immunology	164	4
Dental pathology	142	3
Clinical microscopy	160	3
Preventive dentistry	128	3
Thesis	-----	4
	1,200	32

The administration of the dental school in its relationship to the other divisions of the university has not been disturbed in any particular. The relation to our liberal arts college, where the first two years of the course are given, is one of friendly cooperation but strict noninterference. The dean of the dental school has no jurisdiction or authority over the predental freshmen or sophomores.

The college of liberal arts confers the degree of bachelor of science on only those who have attended that col-

lege for at least one of the two predental years and who have completed the required course for that degree. At Marquette University, the courses required for this degree are eight semester hours of a foreign language and six semester hours of philosophy, consisting of ethics and psychology. The degree of bachelor of science is conferred on the student at the time that he receives his degree in dental surgery from the dental school. This degree might be conferred at the end of the second or junior dental year, but we have found it more convenient in building our curriculum to have the thesis required for the bachelor's degree written in the senior year in preference to the junior year. All graduate degrees, such as master of science, are given by the graduate school of the university, although the work leading to that degree is done by the graduate dental faculty, with the approval of the dean of the dental school, in accordance with the rules governing graduate work in dentistry of the Dental Educational Council of America.

The quality of the work done during the past year by the prejuniors or first year dental students met with our expectations. The lowest general average for the year was 83 per cent; the highest, 91 per cent. The lowest general average in the dental technic courses was 87 per cent; the highest, 91 per cent. These students, as a group, excelled the sophomores in the four-year course in the medical sciences, and, by the end of the year, they equaled the sophomores in the dental technic courses, notwithstanding the fact that the sophomores had had the seeming advantage of an additional year of instruction in technic work.

This good record reflects one of the happiest results of the two-three-graduate plan; namely, that deficient students cannot secure admission to the dental school. The dental faculty is almost entirely freed from the unpleasant and often impossible tasks of attempting to influence and teach incompetent students. Ninety per cent of the responsibility of eliminating poor students is placed on the liberal arts faculty. That the requirements of the present day liberal arts college are high is evidenced by the thousands of students, particularly freshmen and sophomores, who, because of poor scholarship, are dismissed from our colleges and universities at the end of each semester. A student who has maintained an average of at least C, or fair, during the first two years of his college course may be depended on to maintain the same scholastic average during his professional course. The student must pass two thorough tests; the first, in the liberal arts college, the second, in the dental college. That the dental profession will benefit is beyond question.

The members of our faculty have found that they can demand more from these well-trained students, and, as a result, it is possible to teach them more in a given time. The capacity that these men have to assimilate new facts related to the medical sciences as well as to mechanical procedures is very satisfactory. Our technic courses are freed from duplication and we can emphasize fundamental principles rather than the mere technical procedures.

Our experience with these students and our knowledge of their capabilities give us the understanding by which we can look into the future with an even greater clarity and confidence than we could a year ago. At that time, I made

the statement that graduate study in dentistry would be encouraged by the two-three-graduate plan. I am more convinced of the truth of this statement now than I was then. Of all the benefits of the two-three-graduate plan, this is the most important because the future progress of dentistry is wrapped up entirely with the development of research. The dean and faculty of any dental school that is not making plans to encourage research work wherever the facilities or funds for such work are available is overlooking the greatest possible contribution that can be made. The dental curriculum that fails to give the utmost encouragement to graduate work is manifestly unsatisfactory from the point of view of progress in dentistry.

A nucleus of dental schools, two in the East and three in the Midwest, have already adopted the two-three-graduate plan. The Dental Educational Council has recognized it by formulating rules that must be conformed to by schools that have adopted it. The Council has further made regulatory reference to the graduate work in dentistry that will be the outgrowth of the adoption of this plan. The Carnegie Foundation, after an exhaustive study of dental education, lasting over five years, strongly favors its universal adoption. There is a growing sentiment among educators in general, particularly in the American Association of Colleges and Universities to study dental educational methods with a view to their improvement, and the outcome of the study will be, I am confident, the adoption of the two-three-graduate plan.

This plan is meeting with increased favor because it prepares and thoroughly tests the student before admitting him to the dental school; because, while it is just as thorough as the other plans proposed, it has the advantage that it meets the present-day insistence of the public for more and better-trained dentists, a demand that cannot and should not be ignored; because it offers emphatic encouragement to research and graduate study; and, finally, because, while admitting the close relation existing between medicine and dentistry, it stands four square on the proposition to maintain dentistry as a separately organized profession.

In venturing the prediction that the two-three-graduate plan will eventually, because of its merit, be adopted by the great majority of dental schools in this country, we find ourselves in full accord with the best educational theory of the day. As President Lowell of Harvard, in an address[1] entitled "Recent Tendencies in Education" delivered at Boston University, June 14, 1926, well put it, the newer thought in education is concerned more with the "character, energy and ambition of the student." "We are moving away from the counting of educational credits, toward a final measurement of the student himself as the product of the system. The advance in his maturity of thought in his capacity to deal with facts and problems, in his ability to use his powers, to apply the knowledge he should have acquired, all this is the object of his education."

Our new plan does just this—it develops character and promotes intellectual growth. These constitute its intrinsic excellence and furnish the guaranty of a bright future.

1. Lowell, A. L.: Harvard Alumni Bull., June 24, 1926.

ANNUAL REPORT OF THE DENTAL EDUCATIONAL COUNCIL OF AMERICA*

By ALBERT L. MIDGLEY, D.M.D., Sc.D., Providence, R. I.

IT is a fitting climax to the activities of the past few years in this era of splendid achievement that the entry of dentistry into the portal of professional excellence should coincide with the publication of the Report of the Carnegie Foundation for the Advancement of Teaching and the opening of this international congress. In circumstances of continuous evolution, as a profession dentistry is maintaining and consolidating its position in the world of learning and growing constantly in public esteem and respect. After restricting itself for long years chiefly to technical procedures, and suffering neglect through ignorance, prejudice and misunderstanding, our calling is now reaping the just reward of its sustained striving and is entering proudly into its own among the learned professions.

Dentistry as a component factor, and a most useful one, in the science and art of healing, has renounced the merely vocational standard of education, and has emerged from its exclusion and gained recognition as an independent division of health service.

The dentist of today is, or should be, no longer content to remain a mere craftsman. He realizes that the mechanical aspects of his art will have a negative or, at best, a doubtful value so long as the biologic laws related to its problems remain unsolved or ignored. He is aware also that a broad cultural foundation is essential to professional training; that a mind to conceive as well as a hand to execute is an essential factor in the health service which he has chosen as his special field.

If the dentist of today, and especially the dentist of the future, is to hold his high place in the community and in public esteem, he must develop that mental culture and breadth of vision which come only from a training that is based on a solid foundation. The mere mastery of technical skill in the mechanics of the profession no longer meets this requirement, for, in principle, dentistry is like medicine, and just as the practitioner of medicine is trained to high standards of knowledge and proficiency, so should the dentist be trained to render in his special field a service of equal excellence. The ministrations of the dentists are, in kind, different from those of the physician, but in quality they should be the same. A profession is not learned in the accepted meaning of the word unless its members are not only trained in technical procedures but broadly educated as well.

So the Council's thesis in a word is this: that educational standards should be raised in proportion to the intellec-

*This report is published in the Transactions, 1926.

tual as well as to the technical needs of the modern dentist. If he is to render to the public what the public is demanding as a concomitant condition of its own higher standards, the modern dentist must base his training and education broadly upon the cultural and humanistic studies, for they are essential to a proper understanding of those contributory sciences which underlie all professional skill and capability.

ENFORCEMENT OF PREDENTAL STANDARD

The following brief presentation of the predental status of dentistry in the educational program is for the information of those who are not familiar with these relations.

In March, 1921, the Council adopted a resolution accepting as an ideal one year of predental collegiate work. As to the date of enforcement of such a standard, it was not prepared to state at that time.

The Council's conclusion definitely to abandon the vocational educational standard based on high school graduation or its equivalent and set a date for the enforcement of a predental year was voted at a meeting in October, 1922, to be effective beginning in 1926-1927. The more this action was discussed in the dental schools and among dentists and others interested in dental education throughout the country, the more widespread the approval became. By 1924-1925, a majority of the schools had attained that basis, and, in 1925-1926, only a small minority stood on a lower foundation. In November, 1924, with sentiment steadily increasing in the support of a better educational foundation for dentistry, the Council made the predental year one of the minimum requirements for the Class B rating also (after 1925-1926), and reaffirms the enforcement of that standard now.

The Council has been informed, directly or indirectly, that all of the dental schools in the United States except the proprietary Class C, Texas Dental College, Houston, Texas, and the Dental Department of the University of California, San Francisco, Calif., will, beginning in 1926-1927, require at least one year of college work for admission to a four-year curriculum, or at least two such years to a three-year curriculum. The four schools in New York State are obliged by the state department of education to require at least two years of college work for admission; that in Rochester requires three; Harvard, Illinois, Marquette, Michigan, Minnesota, Pennsylvania, Pittsburgh, Tufts, and Western Reserve are among the schools that have announced a two-year entrance requirement. The dental schools in Marquette University and Pittsburgh University announced the adoption of the two-three-graduate plan in 1925 and enrolled freshmen students on that basis in September of that year. The dental schools at Michigan, Minnesota and Tufts will operate under the two-three-graduate plan in 1926-1927. Similar announcements are pending in other schools.

There are now forty-two dental schools in the United States, thirty-four of which are university schools, and thirteen of these, or 38 per cent, have announced or are enforcing a two-year preprofessional collegiate entrance standard. In effect, there are but forty schools, for Texas Dental College, Houston, Texas, and Cincinnati Dental College, Cincinnati, Ohio, are in Class

C. The Texas Dental Board still examines the graduates of the Texas Dental College. In relation to the examination of future graduates of the Cincinnati Dental College, the Ohio Dental Board recently announced that, hereafter, it will examine only on graduation the members of the present sophomore, junior and senior classes in that institution. These figures indicate clearly the sentiment that dentistry cannot function effectually on the vocational educational basis of high school graduation and that its elevation to a preprofessional basis equal in time and scholastic quality to that of medicine is imminent.

In view of the action of the Council alluded to earlier in this report; the conclusions of the Carnegie Foundation; the number of schools announcing the experiment of two years of preprofessional training, and the necessity for dentistry to be equal in all respects to the hypothetical oral specialty of medicine, two years of predental education must be required in the very near future. We cannot escape the inevitable. Dentistry is destined to develop upon a two-year preprofessional collegiate basis. Clearly, one predental year has a passive value and a passing interest. If two predental years are to be required eventually, why not now? In reality, that status is here now. The only sufferers from the enforcement of such a standard will be the independent proprietary and nonproprietary schools and dental schools weakly related, organically or otherwise, to universities.

The enforcement of two years of preprofessional education should not only stimulate and interest officers of universities in their dental schools: it should enlarge dentistry's usefulness in the university family; invite a more cordial and effective medicodental relationship; develop dentistry as a profession in public respect and esteem; eliminate the remaining proprietary schools, and broadly educate and develop the dentist so that he will be better trained for the technical procedures of his calling, and thus promote research and develop good teachers, the lack of which desiderata, in the absence of endowment, is one of the outstanding deficiencies of dentistry today.

SIGNIFICANCE OF ENDORSEMENT OF FOUNDATION

The action of the Council in May, 1925, endorsing the formal conclusion of the Carnegie Foundation, "That dentistry is an independent division of health service which is attaining the full equivalence of an oral specialty of medicine, and commends these views of the Foundation to the attention of the public and of the medical and dental professions," has a significant relation to the present forward movement in dental education.

Among other things, it was pointed out convincingly, in an analysis of the import of this action, in the 1925 Report of the Council presented at Louisville, that dentistry is unequal at the present time in scope and in quality to the demands of a hypothetical oral specialty of medicine; that, if it should be developed solely as an authorized specialty of medicine under medical educational standards, it would be reasonable to conclude that students of the oral specialty of medicine would be required to meet the same entrance standard that is exacted from all undergraduates in medicine, the minimum of which is two years; that it was not possible for dentistry ever to attain the

full equivalence of an oral specialty of medicine as an independent division of health service unless it should enforce a period of preprofessional education (two years) equal to the entrance standards of medicine, and that it logically follows that, eventually, two years of collegiate education will be required of all students of dentistry. In conclusion, it was stated that the one-four plan is the forerunner to the two-three-graduate plan, and whether three or four years of undergraduate study are essential to the education and training of a general practitioner of dentistry will be ascertained by the *test* of that plan.

THE TWO-THREE-GRADUATE PLAN

Whether dentistry should now become a specialty of conventional medicine or continue as an independent division of health service has been answered by the Foundation. The conclusions of Dr. Gies, who has acted so capably and judicially, are accepted generally by detached and disinterested students of dental education and in certain schools that have studied the problem on its merits. With fourteen, or 41 per cent, of the thirty-four university schools announcing a two-year preprofessional collegiate basis of entrance, and fortunately, the strongest of these committed to a test of the two-three-graduate plan, the future of dentistry as an independent division of health service seems assured.

The two-three-graduate plan has the endorsement of the Council because it provides (1) a liberal education equal in scholastic equality to the preprofessional collegiate requirement of medicine and also affords early opportunity to test capability for dental practice by revealing the quality of appetency or discovering ineptitude, as the case may be; (2) an undergraduate dental curriculum of intensive and well-integrated effort for the training of general practitioners only, thus taking into consideration, in a practical way, economic phases incident to the education and training of dentists, and eliminating waste, trifles, irrelevancies and "pet schemes" from dental school curriculums; (3) optional supplementary full-year graduate curriculums for advanced training in all types of dental and oral specialization which should automatically promote research and improve teaching in and develop teachers of dentistry; (4) an optional combination of medical and dental curriculums for the development of the most difficult aspects of oral medicine, which should assist effectively in the promotion of cordial cooperative effort in the medicodental relationship.

The plan aims to have dentistry share some of the assets of medical teaching without assuming any of its liabilities; avoids slavish imitation of outworn standards of medical education; offers a pertinent suggestion for the development of the specialties of medical practice; furthers educational sincerity in the enforcement of entrance standards, and presents a sound basis of procedure for the safe initiation of dental practice.

Ideal in theory, yet readily attainable in practice, the soundness and serviceability of the plan as here outlined ought to commend it to all from the standpoint of altruism and progress.

MEDICODENTAL RELATIONSHIP

In a paper entitled "Medicine and Dentistry,"[1] Dr. Pritchett, president of the Carnegie Foundation, says, among

1. Pritchett, H. S.: J.A.D.A., 13: 1160 (Aug.) 1926.

other things: "While the primary object of both medicine and dentistry is to serve the cause of public health, there has been little cooperation between the associations of physicians and dentists or between individuals of the two professions." He also says: "The question (whether dentistry is to continue as a separate independent division of health service or eventually become a specialty of medicine) is one to be determined upon the basis of adequate health service. It calls for unprejudiced and statesmanlike action on the part of both groups of practitioners and the associations that represent them. The public has a right to expect that intelligent cooperation shall unite these two bodies of health workers in a service whose responsibilities they share in common."

Dentistry has developed in its own way as an independent division of health service since the divergence from medicine in 1839; and since it has persisted with credit in such independence, and grown in usefulness as well as in the confidence of the public, it behooves us to see to it that it becomes in essence the full equivalent of an oral specialty of medicine.

In the view of the Foundation, the unusual mechanical and esthetic phases of its procedure have justified and continue to require its active development as a separately organized profession; and the long continued indifference of medicine to the relationships of the teeth in health and disease suggests that dentistry would be neglected by the medical profession if it were added to medicine. The report further states that the success with which dentists have brought dentistry to its present state of usefulness and opportunity indicates unmistakably that the leadership of the dental profession will develop dentistry to its full possibilities in health service.

Obviously, then, there appears no practical reason why dentistry should become a specialty of medicine, provided it develops properly. Also, it is equally evident that its development will be weak and passive unless there is a cordial and effective cooperation in the medicodental relationship; for this, with its components, research and good teaching, as has already been stated, is the weakest link in the dental educational program, outside of endowment.

Dentistry has been and is now neglected in many universities largely because it lacks endowment and the interest and influences which funds create. It has been retarded in its growth through the apathy of some boards of trustees and the indifferent assistance of medicine in the solution of its problems. Constant allusion to dentistry's academic, scientific and professional deficiencies will serve little or no useful purpose until the cause, and not the results, of these weaknesses is corrected at the source, i. e., sound and effective university control and guidance in the management of its policies, with *all* members of the university family working actively and sympathetically, with one common goal in view. Not until then will the public reap the benefits which will surely accrue from such a policy of enlightenment.

Seeing that diseased teeth are the cause of, or directly related to, systemic disturbances, as so plainly pointed out in the past decade or two by many writers, how is it possible for medicine, with its members enjoying the results of a broad cultural training, to sit by idly and withhold from dentistry the sympathetic and active support in this

great problem of education to which we have so reasonable a claim? Can any justifiable reason be offered why the resources (other than financial) of medicine should not be utilized in dentistry's health service program for the public welfare? Without endowment and effective medicodental cooperation, and its concomitants, research and capable teachers, the plan to develop dentistry's responsibilities in the field of health service will be of little avail. The conclusions of the Foundation have been presented after an impartial survey. Action, not words, is now in order in dentistry's educational program. The public must be awakened to its obligation properly to endow good dental schools.

One of the most significant actions of the Council in its effort to promote progress in the public interest was the endorsement of the statement in the president's report, 1925, page 79, which reads as follows: "The most important problem immediately ahead, on this route of progress in professional education, is the radical improvement in universities of inferior dental schools that have been given indifferent attention and which have been conducted, like proprietary schools, as agencies for financial profit."

A dental school can grow into its full measure of usefulness only through wholesome (organic) university relationship, which means, among other things, adequate financial support, sympathetic and effectual guidance, active research, a good library, capable and interested faculties and cordial cooperation, especially between the faculties of the schools of medicine and dentistry. It is universally admitted that these elements are fundamental in the development of the future progress of dental education, and, in the view of the Council, it is no longer possible for a university dental school to continue to hold a Class A rating unless these cardinal essentials are continuously fostered and promoted.

Some of the deficiencies of some of the university schools included in Dr. Pritchett's statement are presented herewith in detail for obvious reasons. They are as follows: weak organic relationship or convenient questionable affiliation; apathetic boards of trustees; half-hearted or negligible medicodental cooperation; inadequate funds; forced existence on fees derived solely from student and infirmary fees; the payments of rental and interest on debts which should be cancelled by universities; exploitation of dental schools, often to support famished medical schools; toleration of inferior scholastic standards—a situation in a proprietary school not difficult to understand—enforcement of the letter but not the spirit of entrance standards by admission of students on the predental basis with low grade scholastic records; ordinary quality and perfunctory interest in professional activities; ignoring of research; failure of faculty meetings to discuss dental education; failure of faculty to contribute to dental literature; poor application of the foundation work of the student in the clinical departments; poor educational perspective of dental members of faculty and others; half-hearted attitude of some teachers of medicodental subjects; failure to provide for those who desire to specialize in practice and to provide for teaching in dentistry; unresisting submission to arbitrary and archaic requirements of state bureaus of professional education; libraries that are poor and not utilized; heavy schedules,

pedagogically unsound, poor in sequence and in quality of scope and application; use of clinical material chiefly for manipulative training and failure to utilize it fully for study and teaching purposes. All such deficiencies should be promptly repaired in dental schools, and the Council should insist on their eradication.

Another progressive step of the Council was its endorsement of the general conclusions of the Carnegie Foundation as presented on pages 77 and 78 of the Twentieth Annual Report of the president, and its commendation of them to all concerned as practical solutions of many of the problems that have engaged the attention of dentistry since its inception. Copies of this action have been sent to the members of all dental examining boards, presidents of colleges and universities in the United States and Canada, deans of dental and medical schools, state bureaus of education, secretaries of state dental societies, and corporations and individuals on the Council's mailing list. For a clearer understanding of the importance of the action alluded to, the general conclusions on the study of dental education by the Carnegie Foundation for the Advancement of Teaching are presented herewith.

GENERAL CONCLUSIONS ON THE STUDY OF DENTAL EDUCATION

Dentistry is an important mode of health service that is related directly to the teeth and closely adjacent oral tissues, and indirectly to other parts of the body and to the organism in general.

Dentistry should be made the full equivalent of an oral specialty of the practice of medicine in the quality and efficiency of its service to the patient.

The unusual mechanical and esthetic demands upon dentistry have, however, fully justified and continue to require its active development as a separately organized profession.

The long continued indifference of medicine to the abnormalities and diseases of the teeth and oral tissues suggests that, if dentistry were called stomatology and added to medicine, oral health service would continue to be neglected by the medical profession.

The success with which dentists have brought dentistry to its present state of usefulness and opportunity, in the face of social disparagement and professional belittlement, and the strength of the evolution plainly in progress, indicate unmistakably that the leadership of the dental profession will develop dentistry to its full possibilities in health service.

Dentistry can be effectually and economically developed to the full service equivalence of an oral specialty of the practice of medicine through extension and improvement, in universities, of that system of dental education which, though separate from medical education, is closely related to it and should be more intimately associated with it.

This extension and improvement could be accomplished without requiring the prospective general practitioner of dentistry to become a doctor of medicine before beginning his dental training, and could best be brought about by pursuit of the following three main objectives: (*a*) the preliminary education and the instruction in the medical sciences should be the same in general scope and quality as for medicine; (*b*) the technical training, the application of the medical sciences, and the correlations with clinical medicine should be sufficient to assure both ability to initiate safely a dependable general

practice of dentistry and capacity to grow in proficiency; and (*c*) the most difficult phases of dental practice should be reserved for systematic graduate study.

These three objectives could be attained through the requirement of (*a*) at least two years of approved work in an accredited academic college, including several courses that would stimulate interest and develop ability in the prospective practice of dentistry, or reveal ineptitude, and (*b*) three years of intensive and well-integrated effort in an undergraduate dental curriculum for the training of general practitioners only, some or all of the years to be suitably lengthened, wherever desirable, to meet special local requirements; followed by (*c*) optional supplementary full-year graduate curriculums for advanced training in all types of dental and oral specialization.

Such a reorganization would place physicians and dentists on the same plane of intellectual quality, and would give them analogous types of health service education. It would develop similar degrees of medical comprehension, ensure mutual respect and understanding and facilitate intimate cooperation in the promotion of the welfare of their patients.

This general improvement in dental education would require reconstruction of the dental curriculum, with special reference to important betterment of the teaching in all of its phases, economy of time without impairment of the efficiency of instruction in dental technology, more useful application of the medical sciences and more advantageous correlation of clinical dentistry with clinical medicine.

The proposed regeneration of dental education would necessitate, in practically all of the dental schools, prompt increase in the number of teachers of the best type, great improvement of the libraries and active advancement of research.

Lacking endowments, and in most cases being obliged to keep the quality of their work to the level of their income from fees, the dental schools in this country and Canada will be unable to proceed with the suggested improvements, unless, individually, they receive large gifts of funds for this purpose.

ACTIVITIES OF THE COUNCIL

During the past year, the Council has held two meetings, one in Louisville, Ky., in September, 1925; the other in Chicago, Ill., in June, 1926.

The following schools have been reinspected: Atlanta-Southern Dental College, Atlanta, Ga.; Columbia University School of Dentistry, New York City; Kansas City-Western Dental College, Kansas City, Mo.; Loyola University School of Dentistry, New Orleans, La.; New York University College of Dentistry, New York City; Ohio College of Dental Surgery, Cincinnati, Ohio, and Ohio State University College of Dentistry, Columbus, Ohio.

Atlanta-Southern Dental College, Loyola University School of Dentistry and Ohio State University College of Dentistry have been granted Class A ratings. Columbia University School of Dentistry and New York University School of Dentistry have been transferred from the "postponed classification" and placed in Class B rating. Ohio College of Dental Surgery, Cincinnati, Ohio, and Vanderbilt University School of Dentistry, Nashville, Tenn., have been discontinued.

To meet the demands of rapidly changing conditions and the forward movement in dental education, the Council is now engaged in a revision of its constitution and by-laws; minimum requirements for Class A dental schools; and questionnaire and rules governing inspection. It is also engaged in a study of the subjects of the predental course.

DENTAL EXAMINING BOARDS AND THE SCHOOLS

Improvement in the coordination and correlation of the activities of the organized agencies of dentistry in a unified effort for the promotion of better health service should now engage the attention of all good influences.

In the past, the effort in this direction lost much of its force and quality through misunderstandings and disagreements which arose largely through the activities of the selfish interests of the commercial régime.

The need of cordial cooperation between the schools and examining boards to meet effectively their growing obligations in this evolutionary period is imperative, in order that the greatest measure of proficiency in practice and the highest degree of protection of the public may be reached through the health service ideal. Sympathetic unity of purpose and action is the keynote in the promotion of their intimacies and responsibilities.

The main objectives in these relationships as presented by Dr. Gies are: (1) provision for a liberal education as a sound basis upon which to initiate undergraduate study; (2) support of an intensive well-integrated program for general practice; (3) a procedure for thorough training in all types and phases of oral specialization, including teaching and research, and (4) a combination of medical and dental curriculums for the development of the most difficult aspects of oral medicine.

With the National Association of Dental Examiners lies the responsibility of effecting statutory changes in the dental laws for a particular license for the specialist. May not the distinction between the general practitioner and the specialist rest legally on this essential difference: that a general practitioner may at any time practice any part of any specialty provided he does so in the routine of general practice and does not hold himself out to be superior to his colleagues in any aspect of dental practice; whereas the specialist is one who publicly avows his superiority to the general practitioner in a particular phase of practice?

The schools and examining boards should be in accord on the question as to what the people are entitled to expect and receive in service from the general practitioner and also from the specialist; for charity service, at the present time, through dentistry, is not comparable in any way to that of the medical profession. The basis for future development in this direction should be determined in order that dentistry may meet fully this important professional responsibility.

The protection offered the public by dental examining boards in the elimination of unworthy aspirants to practice is a subject for serious consideration. A recent investigation shows that in the past five years, 60 per cent of the product of medical diploma mills have been licensed, i. e., medical licensing boards have proved less than 50 per cent effective in keeping out of legal practice the uneducated and untrained physician.

To the credit of the dental examining boards of the United States, it may be stated that the "graduates" of diploma mills and so-called schools of mechanical dentistry are not admitted to the dental licensing examinations of any state in this country. Of the schools in the Council's classification schedule, which includes all of those actively operating in this country, the graduates of Class A and Class B schools only are examined by the dental boards of the United States, excepting in the case of Ohio and Texas.

In view of dentistry's promotion to a professional basis and other advances, the character of licensing examination requires extensive revisions adequately to meet changing conditions. The primary function of an examining board is to protect the public from incompetency and disease, i. e., ability to practice and all it implies. Outside of determination of ability of the graduate, it automatically acts as a precautionary check on the schools; and so it should not only function to determine ability to practice but also act as an agency for the improvement of health service through education by calling attention to deficiencies of schools as reflected by examinations.

The Council's functions are civic, educational and professional, and so it appears logical for it to take the initiative in bringing about effective accord and practical relationships between the schools and the dental examining boards by seeking (1) to formulate the fundamentals of general and special practice; (2) to eliminate waste and nonsense from dental school curriculums; (3) to improve conditions of state boards and the quality of their examinations, and (4) to promote liberal legislation in support of the essential conditions of modern dental practice.

DENTAL EDUCATIONAL COUNCIL OF AMERICA

Statement of Cash Receipts and Disbursements

Sept. 1, 1925—July 31, 1926

Balance on hand, Sept. 1, 1925		$ 271.64
Receipts		
American Dental Association	$12,025.00	
Interest on bank deposits	10.69	
Total Receipts		12,035.69
		12,307.33
Disbursements		
Traveling expenses for Council meeting, Chicago	1,439.88	
Traveling expenses for inspection trips	1,581.53	
Expenses of Tabulation Committee	790.00	
Printing and stationery	138.50	
Office supplies and expense	51.10	
Stenographic services	92.06	
Telephone and telegraph	398.37	
Professional services	76.71	
Administrative expense	1,100.00	
Notes, National Bank of Commerce, paid	6,000.00	
Interest on notes payable	109.44	
Postage and express	173.62	
Floral gifts	50.48	

Office equipment:			
Stamping machine	$35.00		
Envelope sealer	60.00	95.00	
Miscellaneous		2.10	
Total disbursements			12,098.79
Balance on hand, July 31, 1926			208.54

DENTAL EDUCATIONAL COUNCIL OF AMERICA

STATEMENT OF ASSETS

July 31, 1926

Cash on Hand	$208.54
Office Equipment	267.50
	476.04

August 10, 1926

Dr. Albert L. Midgely, Treasurer,
Dental Educational Council of America,
Union Trust Building,
Providence, Rhode Island.

DEAR SIR:

Following your instructions, I have analyzed the expenses of the Dental Educational Council of America for past periods, November 1, 1924 to July 31, 1926, and present herewith a Budget for the fiscal year August 1, 1926 to July 31, 1927.

Respectfully submitted,

GEORGE M. REX,
Certified Public Accountant.

BUDGET FOR FISCAL YEAR

Aug. 1, 1926—July 31, 1927

Telephone and telegraph	$ 415.00
Postage and express	165.00
Professional services	100.00
Administrative salary	1,350.00
Printing, stenography and supplies	478.00
Traveling expense-Council meeting, Chicago	1,800.00
Traveling expense-inspection trips	2,500.00
Office equipment	90.00
Expense for Tabulation Committee	775.00
Loan from bank	500.00
Miscellaneous	50.00
	8,223.00

All items not specifically commented on below were arrived at by using average expenses for the period of November 1, 1924-July 31, 1926, as embodied in two reports dated August 31, 1925 and July 31, 1926.

Administrative Salary - $1,350.00: This item contemplates an increase of $150.00 for the ensuing fiscal year.

Printing, Stenography and Supplies-$478.00: The above mentioned amount comprises an average plus a printer's estimate of $120.00 on a special printing job.

Traveling Expense-Council Meeting, Chicago-$1,800.00: This amount is based upon an expected attendance of eighteen members at an average expense per member of $100.00. At the March, 1924, Chicago meeting, the average expense was $103.50 for twelve members and the June, 1926, Chicago meeting resulted in an average expense of $96.00 per member for fifteen members.

Traveling expense—Inspection Trips—$2,500.00: This amount is an estimate by A. L. Midgley, Treasurer, based on inspection expense west of the Rocky Mountains of approximately $1,500.00, and the balance for inspections east of the Rocky Mountains, the average expense of which has been $175.00 to $200.00 per inspection.

Loan from Bank-$500.00: This amount is for inspections of Atlanta, Kansas City and Loyola not included in the last budget, and the secretary has been authorized to borrow on the Dental Educational Council's note.

August 10, 1926

Dr. Albert L. Midgley,
Union Trust Building,
Providence, Rhode Island.

DEAR SIR:

Following your instructions, I have examined the books of account of the Dental Educational Council of America, Dr. Albert L. Midgley, Treasurer, for the period of Sept.

1, 1925-July 31, 1926, and present herewith a Statement of Cash Receipts and Disbursements for the period of Sept. 1, 1925-July 31, 1926, and a Statement of Assets at July 31, 1926.

Cancelled vouchers supporting all disbursements were examined and found to be correct. The cash balance of $208.54 was verified by a detailed examination of receipts and expenditures and by reconciling the balance as shown by the books of account with a certificate of balance obtained from the depository.

I hereby certify that the accompanying Statement of Receipts and Disbursements and the cash balance are correct, as shown by examination of the books of account.

Respectfully submitted,

GEORGE M. REX,
Certified Public Accountant.

DIFFERENTIAL DIAGNOSIS OF SYPHILIS, NONMALIGNANT AND MALIGNANT TUMORS OF THE MOUTH*

By JOSEPH C. BECK, M.D., Chicago, Illinois

WHILE there is at times considerable difficulty in differentiating clinically between syphilis, and benign and malignant tumors of the mouth, I am sure that the laboratory will always assist in making the correct diagnosis by means of the smear, culture, examination of the fluids of the body or the microscopic diagnosis by a biopsy of tissue removed.

The anatomic locations in which I shall consider these three pathologic processes are as follows: all parts of the mouth from the lips to the pharynx, that is, lips, teeth, gums, hard and soft palate, tongue, cheeks, floor of the mouth, salivary apparatus, antrum of Highmore, floor of the nose and the lower jaw.

Syphilis may be manifest as (1) primary chancre; (2) secondary syphilis; (3) tertiary syphilis or gumma, or (4) congenital or hereditary syphilis.

The end results of healed scars or contractures, with their concomitant pathology, must also be considered.

Benign growths of almost every kind that has ever been described have been found in the localities mentioned above, but there are some that have a predilection for developing in the oral cavity; for example, cysts of the floor of the mouth, dentigerous cysts and adamantinomas of the lower jaw.

Under the malignant form of tumors, the two great divisions are: sarcoma and carcinoma. The endothelioma is a truly borderline growth from the standpoint of benignancy or malignancy; that is to say, an endothelioma of a certain type, endothelioma endovascularis, can taken on malignant characteristics as to rapid growth as well as metastasis; whereas, endothelioma perivascularis is usually benign in its growth. That factor holds also for other forms of nonmalignant tumors and, conversely, some forms of the

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1926.

malignant type may be very mild in their growth or destruction.

Microscopic examination will show the varieties of cells, as, for instance, prickle cells, squamous cells and columnar cells, arranged in a glandular variety, much or little connective tissue, with much or little hornification and pearl formation of epithelium. Or the cells may show great or little activity of cell nuclear division. These cells may be clearly differentiated or there may be a great mixture of them. There may be a tendency to giant cell formations and there may be coloring matter (pigment) present. In the sarcomas, there may be the same proposition to consider as to round cells, spindle cells, large or small, giant cells, and much space filled with blood (blood lakes lined by endothelium). These cells may be clearly differentiated or mixed.

The connective tissue may be scanty or in great preponderance (fibrosarcoma). The presence of pigment is very significant in sarcoma. These microscopic differences play an important part in diagnosis and prognosis.

In consideration of the etiologic factors as to diagnosis, we may find *Spirochaeta pallida* in syphilis, at least in the primary and secondary lesions. Nothing is known as to the specific cause of neoplasms, although the irritation theory must be very seriously considered in neoplasms, especially in the malignant form and particularly in the epitheliomas. Serologically, of course, the Wassermann reaction, when it is 4+, indicates syphilis, but the negative Wassermann does not exclude that diagnosis. Again, a patient having a neoplasm, whether benign or malignant, may also have a 4+ blood Wassermann reaction. The therapeutic test by arsphenamin or potassium iodid is of distinct value in diagnosis. Too lengthy a therapeutic test may, however, prove extremely costly, especially in the case of rapidly growing carcinoma or sarcoma.

In connection with the subject, I would like to mention that some of the other chronic granulomas, such as in tuberculosis, rhinoscleroma and actinomycosis, may appear as benign or malignant growths and must be reckoned with in the diagnosis of the three conditions we are considering. Here again, the laboratory must be depended on as a great aid. In considering laboratory examination, the roentgen-ray diagnostic laboratory must not be overlooked because, in the filming of certain growths, one can make out either differences in consistency such as a bony or cartilaginous consistency of the neoplasms or the pressure effect on the bony structure in its vicinity.

TISSUE CHANGES AND REGENERATIVE POTENCIES IN PARADENTAL DISEASE*

By KAETHE W. DEWEY, M.D., Chicago, Illinois

IT is commonly agreed that the term "pyorrhea alveolaris" is not the most suitable for this disease. Yet none of the many other names that have been proposed or used in its stead by various writers have been generally adopted or recognized as more satisfactory. "Pyorrhea" is one of those words which, through use, have assumed a very definite meaning that is not originally implied in them. If such terms also have the quality of brevity, they are not so readily discarded. A real acquisition in our dental terminology is the term paradentium, introduced by Weski. Paradentium is the collective name for all the tissues alongside the tooth, which, in including the gingivae and the alveolar process with the periodontium, takes into account the fact that these tissues form an anatomic and biologic unit. An inflammation of some or of all of the paradental tissues is a paradentitis, which, according to the involvement topographically, may be apical or marginal, and the latter of which may be superficial or deep. It cannot be denied that this term has a decided advantage over those having the prefix "peri," such as pericementitis, periodontitis, peridentitis, periodontoclasia, which do not imply an involvement of the gingivae nor the bony socket. The alveolar process is probably never wholly uninvolved in inflammations of the periodontium. Pyorrhea alveolaris, as a paradental disease, is essentially a chronic marginal paradentitis.

A thorough knowledge of the etiology of a disease is indispensable, not only for the proper understanding of the pathologic, i.e., the reactive, changes of the tissues involved, but perhaps even more so for the recognition of the clinical methods that are to be employed. In the case of pyorrhea, the diversity of the therapeutic measures employed and the uncertainty of the results are a true reflection of the lack of agreement concerning the etiologic factors. There are the constitutionalists, who claim that constitutional causes are the condition *sine qua non;* without constitutional disturbances there is no pyorrhea. The localists are equally firm in their conviction that in various abnormalities in occlusion, traumatic occlusion, in short, local causes are sufficient to produce pyorrhea; while the fusionists admit both causes to exist. It is probably safe to say that the view of a predisposition from constitutional disturbances as the determining factor in the development of pyorrhea is gaining more and more recognition. The tissues of the

*From the Research Laboratory of the University of Illinois College of Dentistry.

*Read before the Chicago Dental Society, May 18, 1926.

paradentium, under the influence of disturbed systemic conditions, become sufficiently changed to be affected by local disturbances which, in other individuals, without such predisposing constitutional factors, are ineffective. In the constitutionally predisposed persons, the fuel for the paradental conflagration is gathered and ready for explosion; the local cause of this explosion is only an auxiliary and incidental factor. That does not exclude the possibility that local causes, if allowed to exert their damaging influence on the paradentium long enough, may produce similar, if not identical, tissue alterations as constitutional factors, and invite pyorrhea.

As to the initial histo-anatomic changes of the paradental tissues, it is most likely that they arise from local circulatory alterations concomitant with the general vascular disturbances. It is a general observation that pyorrhea is especially frequent in persons afflicted with diseases of the blood or disturbances of the circulatory apparatus, such as the anemias, chlorosis, leukemia, cardiac disturbances and nephritis; or in those who suffer from infectious diseases and intoxications that cause changes of the blood, such as typhoid fever, malaria, syphilis and mercury or lead poisoning, or from diseases associated with trophoneurotic disturbances, such as tabes and diabetes; or, finally, from the nutritional disturbances caused by vitamin deficiencies, such as scurvy and rachitis.

Vascular derangements cause changes in the tension of the tissue, and it is obvious that such changes cannot be without consequences in a tissue such as that of the periodontium which is suspended between two unyielding bony structures; tissue that contains such highly important formative cells as the cementoblasts on one side and the osteoblasts on the other, whose functional ability is so essentially dependent on the vascular supply.

Some writers are of the opinion that gingivitis is the primary process in pyorrhea from whatever cause. Admitting that in many cases the results of changes of the circulation and tissue tension are first manifest in the gingivae, it cannot be assumed that the vascular derangements will remain limited to the gingivae for any length of time; for there are no anatomic boundaries between this tissue and the periodontium, and the blood and lymph supply of either is connected with that of the alveolar bone. As local factors, such as abnormalities in occlusion and pressure from plates and bridges, also may induce gingival inflammation, the first stage of which, as in any inflammation, is hyperemia, the same conditions as those arising from constitutional causes may prevail and lead to pyorrhea. We may then state that alterations in the circulation and the tissue tension which in themselves already constitute an alteration of the tissue are not only the first but also the fundamental causes of the pathogenesis of paradental disease. All constitutional diseases, therefore, which are characterized by disturbances of the blood or the vascular apparatus must be regarded as important etiologic factors in the development of pyorrhea.

Of the various pathologic changes taking place in the paradentium in pyorrhea, the involvement of the alveolar bone may be considered as the most distinctly characteristic feature of this disease. The question as to whether the bone lesions are primary or sec-

ondary to inflammation of the gingivae or the periodontium is not unanimously decided. Each theory has the support of authorities. Clinically, the disease may start in the gingivae. That does not, of course, exclude the possibility of coexisting pathologic changes of the alveolar process; these are merely not yet clinically manifest. Hopewell-Smith,[1] Talbot,[2] Fleischmann and Gottlieb[3] and others emphatically uphold the theory that the alterations of the bone are primary.

The osseous changes in pyorrhea frequently appear in a form of atrophy of the alveolar process, which is known as halisteresis. There has been, and there still is, considerable discussion about the nature of this peculiar process. In this condition, the bone in the involved area loses its homogeneous appearance and

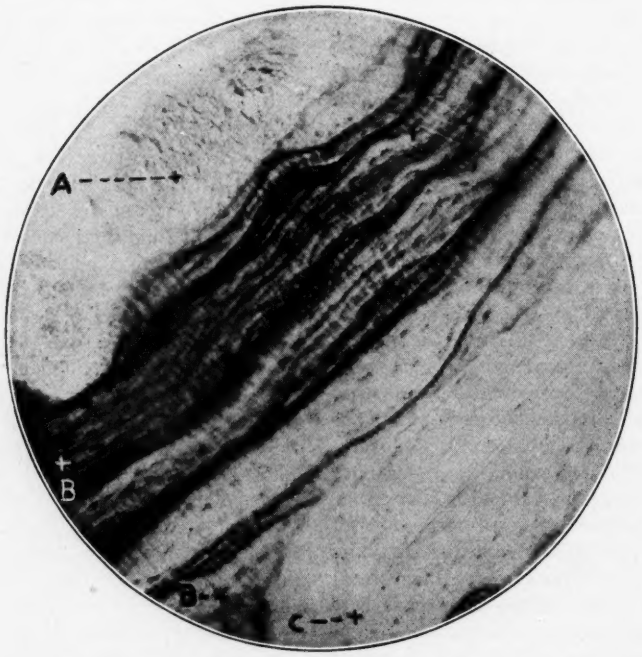

Fig. 1.—Halisteresis of the alveolar process: *a*, periodontium; *b*, area involved in halisteresis, the process extending from the periodontium across many appositional layers to the haversian system, *c*. (× 140.)

1. Hopewell-Smith, A.: Pyorrhea Alveolaris, Dent Cosmos, 53:397, 1911.

2. Talbot, E. S.: Interstitial Gingivitis and Pyorrhea Alveolaris, Toledo, Ransom and Randolph Co., 1913.

3. Fleischmann, L. and Gottlieb, B.: Beiträge zur Histologie und Pathogenese der Alveolarpyorrhoe, Osterr. Zeitschr. f. Stomatol., 18:44, 1920.

presents a fibrillated structure. The common explanation is that this change is due to the deprivation of the bone of its calcium salts. Some investigators question the atrophic nature of this condition and assume that the fibrillation may represent new formation of

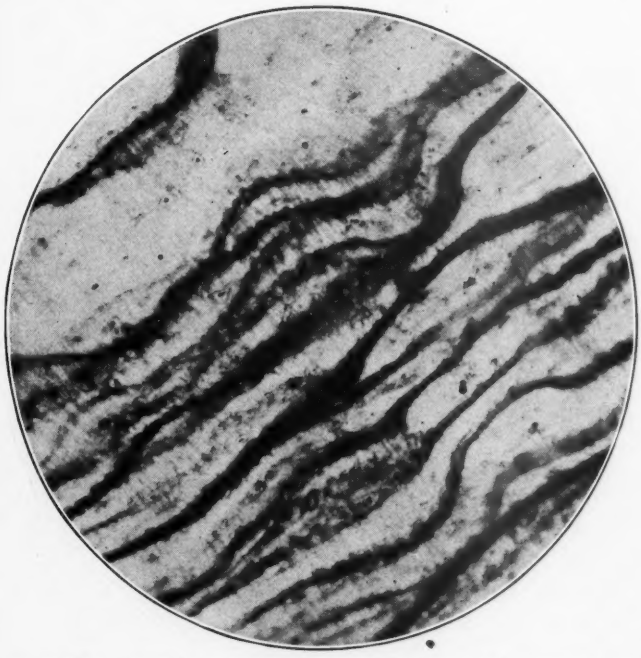

Fig. 2.—Halisteresis of the alveolar process. In the upper left corner, a small area of the periodontium is seen. The decalcifying process is unequal in intensity and localization; in the broad layer near the periodontium, the bone corpuscles are more distinct than in the adjacent layers. The dark interappositional lines show peculiar, small circular and semicircular lines, which apparently demarcate the cementing together of bundles of fibers. (× 230.)

bone. Pommer,[4] one of the best authorities on normal and pathologic bone formation, holds the view that bone absorption in general takes place by osteoclasis or lacunar absorption; that the part played by perforating vessels is negligible as compared with that of this form, and in the condition described as halisteresis and considered as atrophy there is also a lacunar or osteoclastic absorption, followed by incomplete or disturbed bone apposition; in other words, new fibrillar bone formation with deficient calcification takes place. Vascular disturbances, with changes of

4. Pommer, C.: Ueber die lakunäre Resorption im erkrankten Knochen, Sitzungsber. d. Akad. d. Wissenschr., 83:17, 1881; Bemerkungen zu den Lehren vom Knochenschwund, Arch. f. mikr. Anat. u. Entwickl., 102:324, 1924.

the tissue tension such as also occur in pyorrhea, involve the formative cells of the periodontium and interfere with regular and complete appositional bone formation; the impregnation of the fibers with calcium salts is not sufficient. This explanation is very plausible, and conditions in which formative processes assume the appearance of degenerative processes, or vice versa, do occur. I have observed irregular and incomplete calcification of the so-called primary cementum which is easily explained on this basis. But I cannot be convinced that the abnormal appearance of the alveolar process observed in pyorrhea in many instances does not indicate atrophy and is not real halisteresis. As the homogeneous structure is lost, fibers appear that run vertically to the surface of the bone. (Figs. 1-2.) Although the process may be observed along the entire surface of the alveolar wall, it is generally localized and does not involve the total thickness of the bone. In conformity with statements by others, I have observed it, as a rule, on that side of the bone which is in contact with the periodontium. (Figs. 3-4.) Apparently, it is the intimate

Fig. 3.—Senile atrophy of the alveolar bone: *a*, cementum; *b*, periodontium; *c*, alveolar bone; *d*, fat tissue in medullary spaces. These spaces are very much widened by absorption of the bone and the cellular marrow is replaced by fat tissue. Absorption by halisteresis is only present in that part of the alveolar bone that is in contact with the periodontium. (× 70.)

biologic interrelationship between these two tissues that plays a vital part in the development of these localized bony changes. Figure 3 shows evidence of a general marked senile atrophy of the alveolar bone resulting in marked widening of the medullary spaces; but the spaces. It is most interesting that, in this case, halisteresis is present not only in the periodontal portion of the bone but also along the inner wall of those medullary spaces that are in direct communication with the periodontium. Apparently, the tissue in these spaces

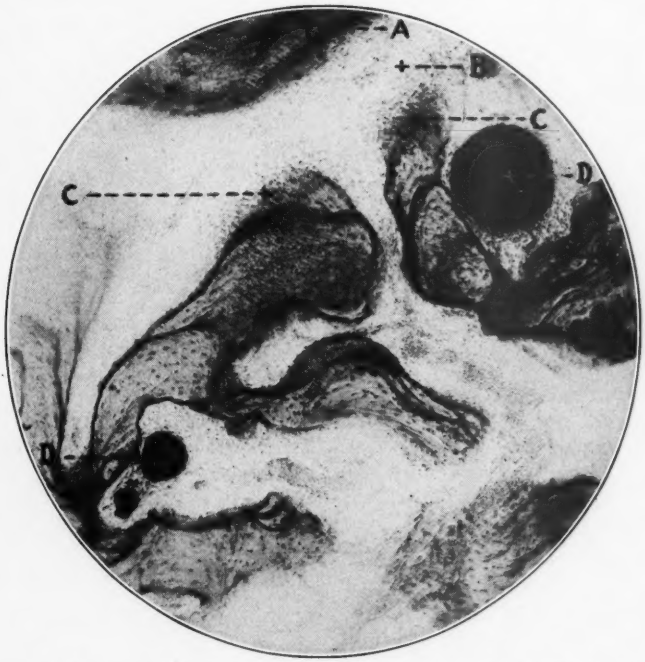

Fig. 4.—Senile atrophy of the alveolar bone: *a*, cementum; *b*, periodontium; *c*, fibrillation of the bone obscuring its outlines. Wide communications between the periodontium and the medullary spaces in some of which cementicles, *d*, are seen.

process of atrophy by halisteresis is manifest only in that part of the alveolar wall which is in contact with the periodontium. Unlike the condition in Figure 3, in which the alveolar wall presents an unbroken surface, there are, in Figure 4, wide openings on the surface with free communications from the periodontium to the medullary has somewhat of the nature of the periodontal tissue, for we also see cementicles lodged in them, and these, as we know, are commonly formed in the periodontium proper.

It is a peculiar observation that halisteresis does not involve the haversian systems. (Fig. 5.) According to the extent of the decalcifying process,

the fibers are long or short. They remain within the boundary of the bone, or they stream out and are continuous with the fibers of the periodontium. In exceptional cases, with very marked halisteresis, such as is illustrated in Figure 6, we may see the process extend throughout the bone and the decalcified fibers stream out into the mucosal connective tissue. As the process goes on, the fibers which are still partially impregnated with calcium salts are converted into ordinary connective tissue, which, however, retains the outline of the former bone. (Fig. 7.) Remnants of bone may be found in the midst of such transformed fibrous tissue. Pommer also explains such observations on the basis of his theory. He states that the disturbances in the formative cells are such that, while portions of bone may be fully formed, in the adjacent regions the fibers remain very incompletely calcified; the transition of osseous into fibrillated tissue is only a local and not a genetic one, and there is always lacunar or osteoclastic absorption previous to the formation of incompletely calcified bone.

Fig. 5.—Interdental alveolar septum with periodontal tissue on either side. The decalcifying process involves the circumferential lamellae along the left alveolar wall and the interhaversian lamellae, leaving the haversian systems intact. The right alveolar wall is not involved. (× 170.)

The pictures of the bony changes

enable us, I believe, to question the applicability of these explanations in all cases. Why does this process never involve the haversian systems, which are not exempt from lacunar absorption? Why do the fibers run across a number of appositional layers apparently having surface, carefully avoiding the haversian systems, and then incomplete new bone formation occurring over this whole area with the same intensity? Why is it that we do not happen to catch the process of lacunar absorption at any place in the act, so to speak?

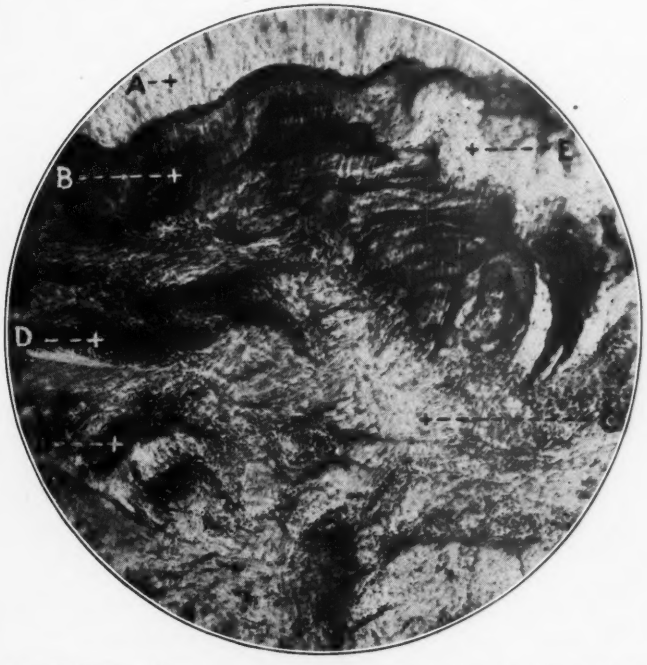

Fig. 6.—Halisteresis of the alveolar process: *a*, periodontium; *b*, remains of the alveolar process; *c*, submucosal tissue with areas of round cell infiltration (*d*). There is a sharp outline of the bone toward the periodontium, while toward the mucosa, the decalcified fibers stream out and blend with the connective tissue fibers. *e*, calcified bone very irregularly demarcated from the decalcified bone. (× 90.)

throughout their length the same deficiency of calcium salts, judging from the intensity of the staining quality? How can we conceive of lacunar absorption taking place throughout the circumferential lamellae from the periodontal wall almost to the mucosal

In Figure 8, we observe osteoclastic absorption side by side with halisteresis. The latter process extends to or from the periodontal surface; the osteoclasts proceed from the endosteum of the medullary spaces. Hence, there is a reversed condition of what Pommer

describes; i. e., the fibrillated tissue that extends throughout this portion of the bone is not laid down into the lacunae, but lies opposite, along the convex borders of the pits. How can we conceive of the occurrence of the most extensive osteoclastic bone absorption and replacement of the absorbed tissue by incompletely formed bone that does not differ in any way from connective tissue? There is no resemblance to the former bone left; only the boundary lines are retained. Is it conceivable that the disturbed local bone formation is so extremely irregular and incomplete that an island of fully mature calcified bone is formed together with totally uncalcified fibrillated tissue? A parallelism to this fibrillation of the bony structure, due to a decalcifying atrophic process, is sometimes seen in dentin. Von Ebner[5] has called attention to the fact that, in areas involved in caries, the original fibrillar structure of dentin sometimes comes into view again.

Fig. 7.—Transformation of the interdental alveolar septum into dense fibrous tissue: *a*, tooth; *b*, periodontium; *c*, connective tissue replacing the alveolar bone; *d*, unchanged bone. (× 75.)

Anatomically and functionally, there is, of course, no difference between incompletely calcified newly formed bone and decalcified atrophied bone. Ac-

5. v. Ebner, F.: Histologie der Zähne mit Einschluss der Histogenese, Scheff's Handb. der Zahnheilk., 1:325, 1922.

cording to the degree of the calcium deficiency, the alveolar bone loses its rigidity and becomes soft and elastic, the attachment by the periodontium relaxes and the tooth becomes loose. And not only is the result of these two processes the same, but the causes underlying these changes are probably very similar.

Weski[6] distinguishes two types of atrophy, vertical and horizontal. The immediate result of vertical atrophy is widening of the periodontium, which is absolute if the absorption takes place by osteoclasis, and relative if by halisteresis; for, in the latter case, while the outlines of the alveolar bone are still more or less completely retained, the partially or totally decalcified bone tissue in the involved area, having been transformed into more or less fibrous flexible tissue for all practical purposes, acts as additional periodontal tissue. The widening of the periodontium ensuing from bone absorption is counteracted, normally and pathologically, by hypertrophy of the cementum. When

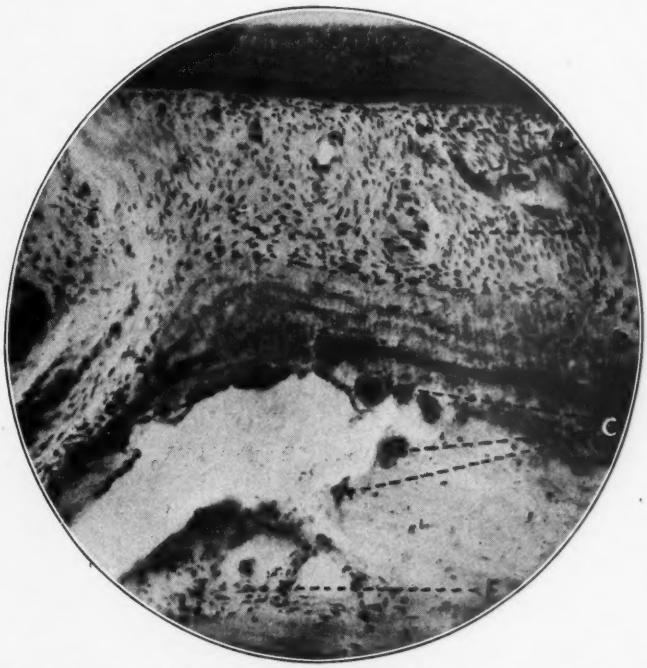

Fig. 8.—Halisteresis of the alveolar bone, with osteoclastic absorption: *a*, cementum; *b*, normal periodontal tissue; *c*, paradental epithelial débris; *d*, absorption of bone by halisteresis; *e*, absorption by osteoclasts; *f*, medullary space. (× 150.)

6. Weski, O.: Röntgenologisch-anatomische Studien aus dem Gebiete der Kieferpathologie. Die chronischen marginalen Entzündungen des Alveolarfortsatzes mit besonderer Berücksichtigung der Alveolarpyorrhoe. Vrtjschr. f. Zahnheilk., 37:3, 1921.

the bone atrophy is very extensive, we cannot expect sufficient compensatory cementification. Excessive cement formation is sometimes found unaccompanied by bone absorption, when the periodontium will be found markedly narrowed.

It is perhaps also partly on this account that the removal of such a loose tooth, however sound it may be, improves the condition; not because such tooth is a foreign body, but because, with the removal of the tooth the abnormal traction on a partially diseased bone is

Fig. 9.—Periodontal tissue beside the tooth and toward the apex; *a*, epithelial proliferation with beginning necrosis; *b*, granulation tissue. (× 45.)

It may be assumed that the relaxation of the periodontium and the looseness of the tooth resulting from bone atrophy cause an abnormal traction on the alveolar wall and thereby produce irritation to the bone and stimulate or aggravate the existing atrophying process. As so often in pathologic processes, the effect becomes cause again. There is a reciprocal action, or a vicious circle. eliminated. Nature has her own way of removing a foreign body, and that is a different way.

Another frequent pathologic process in pyorrhea is the proliferation of the epithelium. This is in no sense a specific feature of the disease. We may encounter it in almost any alteration of the subepithelial connective tissue in any part of the mouth; for it is the altered

condition of this tissue that makes the proliferation of the epithelium possible. Normally, connective tissue and epithelium hold each other in check. Healthy connective tissue is the strongest barrier to epithelial proliferation downward. Vascular disturbances, with changes of the tissue tension, are not only the primary factors of bone lesions: they are also the first factors in weakening the resisting power of the connective tissue. They constitute in themselves an alteration of this tissue. Epithelial proliferation is a common occurrence in the mouth. We may observe it in any tumor or hypertrophic tissue which projects into the oral cavity and thereby is subjected to irritation from local causes. It occurs in tuberculous or any other inflammatory involvement of the mucous membrane, because, in all these conditions, the subepithelial connective tissue is generally more or less gravely involved.

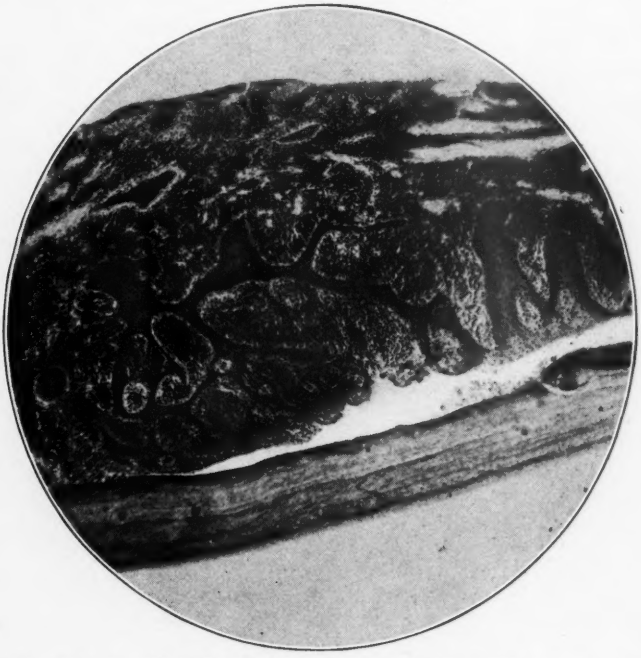

Fig. 10.—Marked epithelial infiltration and granulation tissue causing deepening of the gingival pocket. (× 60.)

Quite often, epithelial proliferation is associated with another very common feature of pyorrhea, which is not any more specific of this disease than the proliferation of the epithelium. That is granulation tissue. (Fig. 9.) The formation of this tissue is simply a reaction to some injurious agent, bacterial in most cases, and it furnishes all those elements that are effective in killing or

neutralizing the organisms and removing the dead and dying material, etc.; in short, it is a salutary process and causes damage only as far as it crowds out more or less of the tissue that normally occupies that area, thereby jeopardizing the normal function of that tissue. The presence of granulation tissue, therefore, also indicates a weakening of the resisting power of the tissue which favors the proliferation of the epithelium downward. These two proliferative processes produce most varied pictures, and such involved tissue has been compared to a bath sponge the framework of which is formed by the epithelium, while the meshes are filled with granulation tissue. (Fig. 10.) As one or both advance, the strong supra-alveolar fibrous tissue, the ligamentum circulare and the periodontal fibers are being destroyed. (Figs. 11-12.) The proliferation of the epithelium along the surface of the tooth causes deepening of the pockets. There is again a vicious circle: the detachment of the strong fibers from the cementum, the presence of a serous exudate, furnishing a good culture medium for bacteria, the lodging of calculus in the pockets; all these factors favor a constant reinfection of the tissue, and this, in turn, stimulates the formation of granulation tissue and the concomitant epithelial proliferation. (Figs. 12-13.)

Fig. 11.—Region of ligamentum circulare; granulation tissue not accompanied by epithelial proliferation. (× 80.)

In treating pyorrhea alveolaris, the

practitioner, consciously or unconsciously, reckons with the recuperative powers of the paradental tissue, however much this may be involved. If all causes, local and constitutional, could be removed, there is no reason to doubt that there would be more or less complete restitution. Nature is indomitable in her will to heal. Bone has marvelous regenerative powers. If the atrophy is caused by local or toxic factors and these can be eliminated, regeneration can be expected to take place. Where constitutional disorders are the underlying cause of the atrophy of the bone and these cannot be remedied, the local treatment, with clearing up of the paradental tissue, will have only temporary results. The fuel for rekindling the local inflammatory condition resides in the systemic disorder. There is a certain analogy between this tendency and that of senilty. Age is a constitutional etiologic factor of atrophy in general, and this process cannot be halted by the most skilful local or any other treatment. Age kills all of us, unless something else carries us off before our time. In premature alveolar atrophy or atrophia praecox, not age, but some other not yet well understood general disturbance is the constitutional etiologic factor.

Fig. 12.—Granulation tissue and absorption of the cementum and dentin across the entire tooth to the pulp canal. (× 140.)

Investigations as to the influence of the internal secretions and the vitamins on health and growth have opened up

possibilities the full scope of which we can perhaps barely guess. I may mention here the observations on the effect of scurvy on the jaws and the dental pulp. Extraordinary pathologic changes in these tissues are produced by a vitamin deficiency of the food, and equally marvelous regenerative changes, by the addition of the proper vitamins to the food. Höjer and Westin[7] have discussed and illustrated these marked changes in recent publications. I obtained the same results. In two guinea-pigs, I protracted the scorbutic disease by occasionally adding fresh vegetables to the diet, just enough to keep the animal alive, but not to interfere with the scrobutic progress. One animal was killed after forty-six days. From that day on, the other was given the vitamin containing diet, and it was killed after seventy-seven days. In the first guinea-pig, the pulp of the incisors was almost completely replaced by bone tissue; in the other guinea-pig, the bone tissue had been largely absorbed again; healthy pulp tissue, with a perfect layer of odontoblasts, occupied the pulp

Fig. 13.—Granulation tissue and irregular absorption of the thick cementum at the apex of the root. (× 90.)

7. Höjer, J. A., and Westin, G.: Studies in Scurvy, Acta Paediat., (supp.), 3:8-278, 1924. Skorbut der Kiefer und Zähne beim Meerschweinchen, Vrtljschr. f. Zahnheilk., 247:40, 1924; Ueber Zahn-und Kieferknochen-Veränderungen durch Skorbut bei Homo, Vrtljschr. f. Zahnheilk., 599:41, 1925.

chamber, and new dentin had been laid down on the partially resorbed bone tissue. (Figs. 14-16.) This illustrates strikingly the wonderful recuperative power of the tissue. Westin reported a similar restoration of diseased pulp and bone tissue in scurvy not only in other animals besides guinea-pigs but also in man. In older individuals, the regeneration is not quite so startling as in young growing individuals. Although the parallelism between this specifically dietary disease and paradentitis, with its multitudinous constitutional and other causes, is not absolute, this example should be a warning not to despair in the battle with paradental disease.

The regression of granulation tissue and restoration of the tissue destroyed by it is the same process as that observed elsewhere in the body. Rekindling of the inflammation must, of course, be forestalled; this is the crucial point. The bacterial infection is a serious handicap, and complication and infection ever have easy access to, and a favorable culture medium in, diseased tissue. Bacteria do not cause pyorrhea; but they favor and maintain this pathologic condition. It is not a spirochetosis nor any other specific bacterial disease. If

Fig. 14.—Case of experimental scurvy in guinea-pig killed after forty-six days; the lower portion of the root of an upper incisor: *a*, periodontium; *b*, cementum; *c*, dentin; *d*, pulp tissue replaced by osseous tissue, which is in the process of cystic breaking down. (× 60.)

benefits are observed from the use of arsphenamin, they are due to the fact that the killing of the spirochetes which are generally present in pyorrhetic lesions removes the immediate cause for the formation and maintenance of granulation tissue with its associated consisting of newly formed capillaries, round and plasma cells, histocytes, fibroblasts and leukocytes in numbers corresponding to the degree of the bacterial infection. If epithelium is present in such a granuloma, a cyst will form as the breaking down of tissue

Fig. 15.—Tooth sectioned in Figure 14: *a*, cellular pulp tissue left in the coronal part of the pulp canal; *b*, osseous tissue in trabeculae laid down on the dentin, *c*; *d*, solid bone tissue; *e*, soft fibrous tissue. (× 60.)

feature of epithelial proliferation. How infectious granulation tissue can be converted into noninflammatory connective tissue is well exemplified in many roots cysts. These develop from root granulomas which arise in connection with infections from the pulp. The root granuloma is nothing but chronic focalized granulation tissue occurs. Quite often, such cysts, at the time of removal, no longer show any sign of inflammation. The wall proper consists of more or less dense connective tissue without any diffuse or focal infiltration or any other sign of an inflammation. It is dense fibrous connective tissue. The original infectious granu-

lation tissue has been converted into ordinary, sterile connective tissue.

When the dentist, in his treatment of pyorrhea in certain phases, encourages hyperemia and the formation of granulation tissue, he really imitates Nature's method of overcoming the infection. To get into her confidence and learn her secrets must be the aim of all treatment. But the fundamental forces of opposition are the constitutional factors which cause a predisposition for paradental disease. It is the eradication of these factors in particular that presents the great difficulty. From the grave trophoneurotic disturbances of tabes, diabetes, etc., to the lighter vascular derangements of anemia and chlorosis, there are only differences of degrees, and in accordance with these degrees are the difficulties of influencing the systemic condition of the patient and making it amenable to local treatment. In pursuing this aim, the dentist and physician should cooperate.

Fig. 16.—Healing scurvy in guinea-pig killed after seventy-seven days; upper incisor. The osseous tissue is absorbed again to a large extent and replaced by normal pulp tissue; *a*, layer of odontoblasts; *b*, predentin; *c*, newly formed dentin; *d*, remains of the osteodentin. (× 60.)

CONSERVATION OF CHILDREN'S TEETH: OPERATIVE TECHNIC*

By PAUL A. BARKER, D.D.S., Denver, Colorado

THE operative management of children is a subject that has apparently been a bugbear to the dental profession since the very beginning of dentistry. Our earliest dental literature contains little or no references to children's teeth. Our modern books show hundreds of pages devoted to the replacement of lost tooth structure in the adult, but one will seek in vain for more than a few paragraphs dealing with the child dentition. Our great institutions dedicated to dental research have hardly touched the immense field that lies in the investigation of the development, eruption and absorption of the deciduous teeth, but have confined themselves instead to the numerous problems of the adult dentition; and yet all who have practiced dentistry must admit that a brokendown, abscessed, deciduous dentition will almost invariably produce lowered resistance in the child through improper nourishment and focal infection, to say nothing of the extremely high percentage of malocclusion with the resulting facial deformities, mouth breathing and pyorrhea.

The term "preventive dentistry" is being used more and more every day in our dental literature and in our private practice, and much stress is being placed on pyorrhea work and oral prophylaxis, and yet, in the majority of cases, these terms are used only in connection with adult work. Webster defines prevention as "a hindering by previous action, an act of caution." If this definition is correct, preventive dentistry is such in name only when it does not include dentistry for children; for at what other period during human life can so many destructive diseases be hindered or prevented? When is there a time that the body responds so quickly and easily to preventive measures as it does in childhood? At no other time can there be a wider or more effective application of the principles of preventive practice, for it is only during these childhood years that developmental defects can be successfully dealt with, and during this time occurs the greatest number of those diseases that so largely predetermine the deformities of later years. Measles, scarlet fever, diphtheria, adenoid, tonsil and dental infection, to which may be ascribed so much of the heart trouble, articular, nervous and other disorders of later years, all occur chiefly in childhood, and methods of control, if they are to avail anything, must be applied then.

It is becoming more and more apparent to many of the leaders of our profession that dentists as a whole have applied themselves too much to the per-

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1926.

fection of the mechanical side of dentistry for the betterment of the adult, while almost entirely ignoring the preventive side of the relief of the child. Our national secretary, Dr. King, stated what should be the real goal of the profession when he said, "The true aim of dentistry is to eliminate itself. The true physician and dentist are not engaged in doctoring, their business is to get to the fundamental causes of diseases and then educate the public to adopt preventive measures. When the program of reparative measures is replaced by one of prevention, the ax will be laid at the foot of the tree." There is no doubt whatever that, in this one branch of our work, we have failed to meet the demands of an exacting public, who are each year becoming better educated in the matters of dental health. I refer particularly to the conservation of children's teeth as practiced in the average dental office of today, not to the work done in our public schools and private clinics where children's work is done as carefully and scientifically as is the adult's, but to the services rendered and the advice given by the thousands of dentists in general practice who now share equally with the medical profession the responsibilities of maintaining the health, happiness and longer life of the American people.

In this field, the medical profession is far ahead of us, for many of the problems of preventive medicine are well formulated and diligently practiced, while this aversion for children's work among members of our profession has become so apparent that the president of the American Medical Association recently chose as the subject of his paper given before that body, "The Care of Children's Teeth, the Most Neglected Feature of Pediatric Medicine," and, in that paper, he states that, "Many members of the dental profession seem woefully ignorant of the importance of the conservation of children's teeth, and so commonly do dentists refuse to accept children as patients that there is often great difficulty in having the necessary work done." He says further, "It has been my frequent experience in trying to save deciduous premolars or even the first permanent molars to have the dentists decline to undertake the work on the ground that it was not worth while." This is indeed a scathing denunciation of our profession and one which we must admit with shame is in many cases only too true.

Our profession is at the present time placed in a peculiarly unfavorable position in its relation to the parents of the school child, for there is hardly a city of any size in the country where some sort of dental education is not being carried on through the public schools either in the form of dental lectures, school dental inspection, health weeks or articles in the school paper. The entire burden of this dental education of parents is "Take your child to the dentist to have his teeth cared for," and the anxious parent, heeding this admonition, hurries to the family dentist with the child, only to be met in many cases with the advice "The baby teeth are only intended to last a few years and then be replaced, so it does not really matter much if they are lost. Fillings to preserve them would fall out in a short time and have to be replaced, so why bother with them? If the second ones come in crooked, they can be straightened later." Thus the voice of ignorance, and it has doubtless salved

many a conscience that should otherwise feel guilty. Whom is the parent to believe? He holds in his hand a notice, signed by a qualified dental inspector of the public schools, advising him that his child's teeth must be filled, and then his own dentist, in whose counsel he has heretofore had implicit faith, offers him the foregoing advice. Being a normal human being with a mind of his own and the ability to reason for himself, he immediately comes to the correct conclusion that somebody has deceived him. Either his child needs his teeth filled or he does not. Both doctors cannot be right, yet both are supposed to be authorities. The usual result is that he accepts the advice of his family dentist and allows caries to continue its devastating course until his child begins to suffer from aching, abscessed teeth, foul breath, deranged stomach and all of the accompanying evils, when the truth begins to dawn on him that, after all possibly the school inspector was right. His confidence in the dental profession as a whole is greatly shaken, and his faith in the ability of his own dentist is completely undermined, the result in many cases being the loss of a desirable family to that dentist, who probably never could understand why that family went to his competitor, who gave the children the same care and attention that he gave the adults.

To the average business man of today, accustomed as he is to close deductive reasoning in his own business, this attitude of many members of the profession toward operating for children must, to say the least, appear very contradictory and peculiar. Is it any wonder that, in spite of all the dental educational work now being carried on, the laity continue to regard the deciduous teeth so lightly when we, as professional men, in our own offices have failed to give them the care and attention that they deserve?

In analyzing this attitude of indifference toward children, we find that there are apparently three main reasons given: (1) ignorance on the part of the dentist regarding the necessity for conservation of children's teeth; (2) a very apparent ingrained fear and dislike which many men seem to have for operating on children; (3) the fact that operations on children have heretofore nearly always been a waste of valuable time for the busy practitioner when considered from a financial standpoint.

The first reason, ignorance on the part of the dentist regarding the necessity for conservation of children's teeth, is due entirely to a lack of training in pedodontia in our dental college. To the young graduate starting practice, the dental college is the fountain head of all knowledge, and he proceeds to put into practice exactly what he has learned in school. Six years ago, there was not a single dental college in the country giving any special attention to children's work, and today you may count on the fingers of one hand those schools that have established a definite course in pedodontia. Our young dentists have, for years, been sent out to establish their practices, carrying with them the old, apparently well established idea that the children who applied for their services were more or less a necessary evil in every practice and their work was to be completed as hastily as possible, if at all, as it was unimportant.

If we as a profession are going to maintain the reputation that dentistry now enjoys as an equal of medicine, and if we ever expect to meet the immense

demand for children's work that is being created more and more each year by enlarged dental educational campaigns, we must eradicate from the minds of our dental students this old idea that children's work is unnecessary, by establishing a course in pedodontia in every dental school in the country.

This second reason for fear and dislike for operations on children in some men amounts almost to an obsession, for many of them would rather "take a beating" than work on a child. This type of dentist should never attempt to work on children, if it is possible to send them elsewhere for services; for it is a fact that they often do more harm than good by arousing in the child mind an unwarranted fear of a dentist, which subconsciously remains throughout life, causing the individual to endure considerable pain rather than consult a dentist, whose degree will always be associated in his mind with fear and pain. There is another type of dentist who will seek to avoid operations on children because he dislikes to cause them any pain. This man is the one to perform operations on children, for he has the natural sympathy for pain which is one of the first things that a child unconsciously seeks in the operator and, in this greater association and familiarity with children, he will overcome that fear of causing pain in the knowledge that this little pain of the present operation will eventually prevent greater suffering.

As regards the third reason, lack of proper financial recompense, members of the profession are themselves to blame for the fact that the laity do not want to pay a proper fee for operations on children's teeth and the reason they do not wish to pay this fee is again answered in three words, "lack of education." How many of you make it a rule to spend ten or fifteen minutes with the mother who has consulted you regarding her boy's teeth, pointing out to her the reasons why the deciduous teeth should be cared for, the cavities filled while they are yet small, the pulpless or abscessed teeth either treated or extracted in order to prevent his very health from becoming impaired? How many of you have taken the time to show her the terrible results of too early loss or too long retention of the deciduous teeth with its resulting malocclusion, facial deformity, and nose and throat and even eye troubles? It is my firm belief that if dentists would spend as much time in educating that mother regarding her boy's mouth as they do in selling a denture or bridge, they would find few parents who would not be willing to pay them their regular fee for services to their children.

In treating children, it should always be borne in mind that a nervous condition of the operator is immediately noticed by the child, and his nervousness and fear of what is to come will be increased accordingly. To the child mind, first impressions are lasting ones; consequently, if possible, let his first visit to you be one that he will remember with pleasure, rather than with fear and trembling. When working for children, it is necessary that your office, your assistant and you yourself be immaculate, for you will find that children are strongly impressed by outward appearances and will oftentimes, in their outspoken way, discuss with their parents the impressions that you and your office have made upon him. I have found it to be an excellent plan to learn the child's first name before he is ushered into the operating room, and

then, when he does appear, to use it in some cheerful form of greeting; for cheerfulness begets confidence, and he is at once impressed with the fact that you called him by his first name although you were a perfect stranger. After he is placed in the chair, explain to him every move you make, for he will be watching you closely, in constant fear that you will unpleasantly surprise him. Be absolutely truthful in your statements to him, remembering that you are on trial and the success of all your future work on that child depends on your gaining his confidence at this time, and once you have obtained this faith, be sure that you do not abuse it. If the tooth has been aching, it is necessary to give relief at once, and, with this relief, a real confidence in your ability is instilled.

From a dental standpoint, the life of a child might be divided into three important and distinct ages, which I would call babyhood, preschool age and school age, and it is going to be one of the important requirements of the up-to-date dentist of the future to know just how to handle children properly at each age. The age of babyhood I would give as from birth to 2 years, the preschool age from 2 to 5 and the school age from 5 on up through later childhood to 12 or 14 years. The age of babyhood is of course considerably limited as far as actual operations on the teeth are concerned, and such operative procedures as are necessary might be grouped under the two heads of prophylaxis and emergency, as they nearly all consist of either the removal of stain from the teeth or the extraction or treatment of a deciduous tooth for the relief of pain. Under the head of emergency would also come the lancing of the gums to permit the eruption of the deciduous teeth, and this is an operation which the dentist and not the physician should be called on to perform, for too often the physician is comparatively ignorant of the exact location, size and shape of the erupting tooth and will use the lance too freely, causing excessive hemorrhage and fright to the child. In these cases, there is nothing that will compare in effectiveness to the actual cautery when it can be used, for it opens the desired space with even less pain than does the lance and requires no anesthetic for its use; the edges of the openings are bloodless and sterile, and you know that one operation is enough, for the edges will not heal together and again imprison the erupting tooth. In using the cautery on a child, great care should be taken to hold the tongue and cheeks away with cotton rolls and napkins and a type of cautery used which can be turned on after it is in the mouth, thus eliminating the fear which grips the child if he sees it heat up. Many times, opening of the tough gum tissue over an erupting deciduous tooth will give immediate relief to the child and will eliminate high temperature, and nervous and digestive disorders that have baffled the skill of the physician.

Without doubt, the greatest field for preventive work during this age of babyhood and even before birth is the field of nutrition and diet, but as this subject could easily occupy an entire paper by itself, it will only be mentioned here. Suffice it to say that, with the published work of Howe, McCollum, Mellanby and others before us, the dental profession must soon realize that the day is not far distant when they will battle the enemy of decay and deterioration in children's teeth, not only from without, with burs and filling materials, but also from within, by

means of proper dietary control for the expectant mother and the child.

The preschool age offers the greatest field for preventive, operative procedures, and it is this age that has probably been most avoided by the dentist, for these little patients are more difficult to handle than the others, standing as they do between the age of babyhood, when you can and generally must perform your work more or less forcibly, and the school age, when the child is old enough to be reasoned with. These children have not yet come under the influence of the school dental clinics and the oral hygiene lectures, and yet they are getting old enough for the mother to neglect the daily mouth cleansing, which was deemed so necessary while the baby was cutting his teeth, and, as a result, you will generally find the mouth of the preschool child badly in need of prophylaxis or repair. A report of the hospital dental clinic for preschool children in Cleveland states that, out of 417 children operated on in one year, 91 per cent had dental caries, 71 per cent had more than five cavities, 34 per cent more than ten cavities and the average was 8+ cavities to the mouth. Fifty-nine per cent of these children had from one to ten abscessed teeth. Fourteen per cent needed orthodontic treatment, and the average age was 4 years.

The school age has had the greatest amount of attention owing to our school clinics and dental inspections, and, during this age, the greatest amount of reparative work must be done. These children probably concern the practitioner more than any other, for they are present in general practice nearly every day. In placing fillings in these deciduous teeth, we are many times faced with a difficult proposition; for it has been my experience that by the time the dentist sees these cases, they are in a pitiful condition indeed, taxing to the utmost our patience and ingenuity in their repair. In this type of operation, we are presented with these problems: (1) we must use a cavity preparation that will give us a maximum of strength and retention with the minimum of cutting; (2) we cannot, in a great many of these teeth, remove all the decay, for, in so doing, we would have a pulp exposure, which is to be avoided above all things; (3) the idea of leaving that decay in the cavity unsterilized is not to be considered; we must therefore resort to one or both of two expedients; the dentin must be sterilized by some agent before the filling is placed, or we must use some type of filling material that is inhibitory to the spread of decay; (4) we must use some type of filling material that has as much adhesiveness as possible and will stay in place with the least amount of retention; (5) it is also necessary that our filling hold its shape and contour under stress of mastication so that our contacts are not destroyed; (6) we must so conduct our work that a maximum may be accomplished in a short space of time, for children should not be given sittings of more than thirty minutes, and so that the very minimum of pain and fright be given; (7) most important, there must be frequent inspection of the work in order to insure good results.

For convenience, we will consider these problems separately. First, the cavity preparation will be controlled by two things, the amount of solid tooth structure remaining and the type of filling material to be used. If a metal

filling is used, it is necessary to obtain a good dovetail preparation and gingival seat or considerable undercut on the buccal, lingual and gingival walls; otherwise, the filling will loosen in a few days and become crowded down into the interproximal space. This requirement eliminates the use of amalgam in some of these cases, for there is not enough solid tooth structure left. If a good copper cement is used, less retention is necessary, and many times it may be used on a flat surface with no retention at all. We prepare the cavity by removing with the bur all the decay possible without endangering the pulp; smooth up the enamel wall with chisels, and then undercut as much as possible with a small wheel or inverted cone bur on the buccal, lingual and gingival surfaces.

Problems 2 and 3 now present, for we have, in the bottom of the cavity, a hard, carious dentin which must be sterilized. There are on the market at the present time a number of agents for which the claim is made that they will accomplish this much to be desired result of perfect sterilization. These claims, of course, are not to be taken as absolutely correct, for if perfect sterilization of decay in all cases were possible, the millennium would be reached, and the dentist, like the Arab, might fold his tents and silently steal away. There is, however, one formula produced in a scientific laboratory by one of our most prominent research men that has proved of inestimable value in these cases, ammonical silver nitrate, developed by Dr. Percy R. Howe and used extensively at Forsyth Infirmary. Experiments have proved that, in many cases, this product will absolutely sterilize carious dentin, and, in office practice, it will, in every case, greatly inhibit the spread of decay. When this solution has been properly used, a firm sterile base results on which to build the filling, and, most desirable of all, there is left the natural roof over the pulp, which is far superior to any pulp capping ever devised.

Problem 4 regarding the filling material, is a problem indeed, and there is room for great improvement in those at present obtainable. It is advisable to use one that has enough copper content to inhibit decay, and this means that it must be either copper amalgam or copper cement. It is the consensus of opinion of those men specializing in children's work that, wherever possible, copper amalgam should be used on all surfaces exposed to the grinding wear of mastication, while, in those cavities where little or no retention is to be had, cement may be used. The only objection to the copper cement is that, in some mouths, it will wear down rapidly under stress of mastication and thus destroy contacts; but this objection may be eliminated to a great extent by frequent inspection and rebuilding at the proper time. It would be a God-send indeed if our research men could give us a material with the adhesiveness, inhibitory action toward decay and nonconductivity of the copper cement, combined with the wear-resisting qualities of the amalgam.

In answering Problem 6, you will find that the maximum of work must be accomplished in the minimum of time, for, after the first fifteen minutes in the chair, the child becomes nervous, fidgety and difficult to work on; therefore, we must waste no time after he is placed. Everything should be ready and accessible; every move should

count, and yet the appearance of haste must be avoided. If you know that a part of the operation will cause him pain, it should be left until all other work is completed, if possible. This especially applies to extractions; otherwise, the work is rendered much more difficult by the child's fear that you will "pull another one."

The last and most important requirement is frequent inspection of our work by means of recall appointments; for, no matter how careful we have been in the placing of these fillings, they will fail much more easily than those in the permanent teeth. No matter how painstaking we are in the matter of sterilizing or pulp capping, we must remember that these deciduous pulps die much easier than do the permanent ones. The only thing that will prevent further damage and pain is frequent inspection and early repair, and this requirement should be carefully explained to the parent at the beginning of the operation.

The filling of deciduous molars is greatly simplified by placing a cotton clamp on the first permanent or second deciduous molar, with cotton rolls under the flanges. This will keep three teeth dry at once, hold the tongue away and enable one to coutour the filling properly. When two cavities approximate each other, the preparation of each is completed, and they are then filled, one at a time, with enough time between the placing of the first and the second fillings to enable the first one to become hard, the operator thus avoiding any possibility of the two teeth becoming joined with a solid filling, which will invariably cause a failure of the work; for the filling will soon loosen because of the individual movement of each tooth during mastication. This requirement prevents the use of copper amalgam in two approximating cavities at the same sitting, as it usually takes several hours for copper amalgam to harden. When it is necessary to place two approximating fillings at the same sitting, the copper cement may be used in one cavity and the amalgam in the other one, the contact with the amalgam being built as broad as possible.

Probably the most common type of caries met with in children, especially the baby and the preschool child, are the mesial and distal cavities on the four maxillary anterior teeth. If these teeth are thin and brittle, there is no more satisfactory treatment than that advised by Dr. Black in his "Operative Dentistry," which consists of trimming them down smooth with a disk, leaving the interproximal space wide and clear for the excursion of food, and then using silver nitrate on the exposed dentin. Ammonical silver nitrate is indicated here also, as it is superior to the straight solution for sterilizing dentin. If the teeth are short and thick, permitting cavity preparation, a white cement or artificial enamel filling may be used with very good results.

The question of the immediate extraction or the treatment and retention of abscessed deciduous teeth causes almost as much argument and discussion as the same question regarding permanent teeth. It is my belief that, in the majority of cases, abscessed deciduous teeth should be extracted, for any advantage to be gained from maintaining the normal space in the arch by the retention of an abscessed deciduous molar is more than offset by the danger to the child's general health from focal infection. In some cases in healthy children in which resistance is high and

mouth care is good, frequently two or three treatments of formocresol followed by a canal filling of alum paste consisting of equal parts of alum, thymol and glycerine will give good results, but these cases are in the minority, and the dentist should use great care in selecting them.

Operations on the first permanent molar, which have been left until the last, must be considered as being the most important work that we can do for the child, and, in their restoration or repair, nothing but the most careful workmanship should be given and none but the best possible material used; for these teeth must serve the child for his entire lifetime, and here might be mentioned the great superiority of the gold inlay in these teeth. Wherever possible this type of filling should be used; for there is no reason why the child, with his whole life of mastication ahead of him, should be denied the advantages of carefully carved cusps, high finish and permanency, without discoloration or recurrence of caries, which the correctly made inlay gives.

The time will never come when there are enough pedodontists to care for the children of our nation. Therefore, it would seem that the only way for the dental profession to discharge its duty to children is for every man to assume his share of responsibility for the education of the parents in his own practice, and for those men who are at all able to handle children to do more and more children's work. It is sometimes difficult work, calling for the patience of a Job and the wisdom and diplomacy of a Solomon, but if we make a conscientious effort to do our very best work on each child we are asked to treat, we are repaid with something far more valuable than gold—the smiles and confidence of children.

SUMMARY

1. The greatest need of dentistry today is competent instruction in pedodontia in our dental colleges.

2. The three apparent reasons for dental neglect of children are ignorance of the dentist regarding the necessity for conservation of children's teeth, a fear and dislike for children's work and a small financial recompense.

3. The first and second reasons may be largely eliminated by the proper education of our dental students and the third by the proper education of the parents.

4. The child has three important dental ages: babyhood, preschool age and school age.

5. The main problems presented in filling deciduous teeth are the type of cavity preparation, the impossibility of always removing all decay, the necessity for sterilization of carious dentin, the type of filling material to be used, the accomplishment of the maximum of work in the minimum of time and a frequent inspection of work after completion.

6. The extraction of abscessed deciduous molars is indicated in the majority of cases.

7. Every member of the dental profession should recognize the demand for oral hygiene and preventive dentistry and lend his aid to these great movements by preaching the former and practicing the latter, thus doing his part to assure the coming generation of their rightful heritage, sound and regular teeth.

FIXED AND SEMIFIXED BRIDGES*

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A DISCUSSION of the partial denture (fixed and removable) problem usually finds the discussers and the audience divided, each claiming superiority for his choice. One group will uphold the fixed restoration; the other, the removable in one form or another. Interspersed will be found many who are not bound to the one or the other; they follow the golden mean, using either type where indicated.

In this problem, there should be a means of guidance for the dentist to arrive at a judicious selection of the type of restoration to be used in a given case. It is not of such importance whether it be a fixed or a removable bridge, but it is of vital importance whether the appliance placed in the patient's mouth will, in addition to restoring lost teeth, help to restore and maintain health and function. It is not so much a question whether we use an inlay or crown for the fixed bridge attachment, or a clasp or other frictional attachments for the removable restoration, as it is a question of restoring normal function and correct structural form.

The problems of the fixed group are the problems of the removable group. Each must restore missing teeth; each must place an appliance that will be sanitary, efficient and esthetic. An unbiased survey will reveal that unless careful judgment is exercised in the selection of type and an ordinary amount of skill is employed in the construction of the appliance, neither the fixed nor the removable denture will be able to withstand continued use and strains. The task that confronts us is not only to restore lost masticating efficiency; more is involved: the appliance should be part of a therapeutic remedy that will aid the patient in his fight against further loss of teeth, and, if possible, protect the edentulous areas against undue degeneration.

To say that these results can be secured by one or another type of prosthesis only is presuming a great deal. Such claims have been and are now being made by certain operators, who disregard the fact that, under certain conditions, the fixed and the semi-fixed bridge will fulfil the desired requirements. It is true that, in the past, there have been, and there may be now, glaring failures of the fixed restoration, but let us stop and consider the causes of these failures. What do we find? A disregard of the basic laws of biology, physics and mechanics. You will grant that a similar lack of application of these principles will result likewise in the failure of the removable type of appliance. If underlying principles

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are grasped and mastered, methods need not hinder, but will rather assist, us.

Prior to undertaking reconstructive work of any type in the mouth, there are three factors which must activate our final decision; namely, the vital, the physical and the mechanical. Since no structure is stronger than its foundation, this phase should receive more attention than has been ordinarily allotted to it. We cannot fail to appreciate the fact that the human body, in its entirety, is the real foundation of any medical or dental effort at reconstruction, and unless we evaluate it as such, our efforts will fail; for it is possible to have structural form without normal function. For this reason, where it is deemed necessary, a thorough physical examination of the patient should not be omitted; for frequently our diagnosis fails to take into consideration the etiology of the present impairment of the mouth. Important as it is to know *how* to restore missing teeth, it is of greater importance to understand *why* they were lost so that we may remove the causes and prevent additional losses.

Having ascertained the condition of the body, we are prepared to proceed without endangering the body with added strain. Not all patients are favorable subjects for partial restorations, either fixed or removable, and it is with these that we must exercise the utmost care.

Our ultimate success or failure depends also on how thoroughly and how accurately we have diagnosed the *mouth* condition, which is the immediate foundation of any appliance. There are certain guides to follow and pitfalls to avoid, in order to arrive at a correct diagnosis. An exhaustive ocular, digital and radiographic survey of the teeth, paradental tissues and the edentulous areas should be made, together with full-mouth study models.

Using these diagnostic aids, what should be our objectives? Do we merely observe which teeth have definite granulomas, pockets or cysts, to enable us to convince the patient that certain teeth ought to be removed and a certain type of restoration inserted? If this is the prime reason for our examination, then we are losing 90 per cent of the full diagnostic potentialities. If our vision carries beyond this point, and our purpose is ultimate rather than immediate, we can then proceed to establish the tonicity of the supporting and investing tissues. We should determine, as accurately as possible, the presence of pathologic lesions, acute or chronic, and whether they have changed the normal functions of the tooth with its paradental tissues; also, to what degree these lesions have altered their structural form.

Having established these facts, the next step is to determine which teeth can safely be retained as abutments and which not. A vital tooth whose surrounding tissues are structurally and functionally normal is the ideal abutment or pier. Having this ideal before us, we are more readily able to decide which teeth are to be retained and which removed. At this time, let us test the tooth for luxation, determining whether the excessive mobility is due to a thin or a missing buccal alveolar plate, or whether it is due to traumatic occlusion. If the former, use of the tooth as an abutment is contraindicated; if the latter, the trauma may be rectified.

The teeth should also be examined with reference to their physical makeup.

We very frequently find a tooth, the coronal portion of which is entirely out of proportion to the length of the root and its attachment. Were we to use a tooth with a long crown and a short root, our restoration would be doomed to failure in a short time, owing to the resultant excessive leverage. Yet the mere fact that the tooth has a long root does not suffice; it must have a healthy and adequate periodontal attachment to the alveolus; otherwise, its use as an abutment is contraindicated. The position of the tooth in the arch and its relation to the teeth of the other arch must likewise be considered at this time. Elongation, marked convergence, divergence or other malposition of the teeth may necessitate their removal, or at least changing the prescribed denture from a fixed to a removable.

Another important consideration is the number and distribution of abutments in the arch. The pontics should not greatly outnumber the abutments when a fixed restoration is contemplated. The distribution of the abutments must be favorable both in relation to other teeth, and in relation to the abutments of the opposite arch. When we find that the axis direction of the abutments is not reasonably near to being parallel, the fixed restoration is subordinate to the removable.

Subsequently, the study models and the teeth are examined for improperly placed fillings, crowns and fixed restorations. All that do not meet the requirements of hygiene, occlusion and contour should be removed without hesitation.

Another question that has confronted the dental profession for some time is that of stress. We are told that more teeth have been lost through overload than through any other cause. You and I have accepted as fact the statement that the abutment teeth carry the cumulative poundage of the entire bridge. To illustrate: in a four-tooth bridge restoring two bicuspids, it has been stated that the cuspid and the molar abutments, in addition to their own load, carried the added 200 pounds of the two bicuspids, making a total load of approximately 400 pounds. Let us verify this to see whether we have not been condemning overload instead of leverage.

There are three possible directions in which a tooth may move; vertically, or into the socket; buccolingually, and mesiodistally. Since Nature normally has provided contact points between the teeth anterior to the third molars, it can be presumed that this mesiodistal movement is negligible. The buccolingual movement may become pronounced when the normal articulation and occlusion have been disturbed, with a resultant traumatic incoordination of occlusal surfaces. The vertical direction, then, is the one to be most affected by the supposed overload.

Most of us have tried to crack a nut between our teeth. Sometimes we were successful, but oftener we were compelled to stop before attaining our end. Did we stop because we were unable to bite with sufficient force? Had the muscles of mastication reached their maximum power? Or was it because we felt a slight pain in the periodontal membrane? If Nature had not been so farsighted in her plan and had she placed the roots in rigid contact with the jaw bone instead of interposing a resilient, sensitive periodontal membrane, many teeth would be irreparably and prematurely damaged. As it is,

teeth will endure only as much force as the periodontal membrane can comfortably bear. When this is exceeded, we are forced to stop because of the pain experienced. A tooth will not endure comfortably pressure greater than that for which it was suited, although its power of endurance will be increased gradually with the continuance of the increased load. Consequently, when a four-tooth bridge is placed, extending from a cuspid to the first molar, we are able, at the time, to exert only such force on the bridge as the abutment can comfortably bear by itself. Of several hundred bridge cases that have been carefully recorded and observed, in not one instance has the patient been able to bite to a greater poundage on the bridge than could be registered on the corresponding natural teeth of the opposite side of the arch.

As a further diagnostic measure, let us study the occlusion in each case. Accurate study models, mounted carefully on an adjustable articulator, are indispensable for this purpose. This will also aid us in classifying the mandibulomaxillary relation, as well as in disclosing unevenly distributed forces. If the bite is a close one, we can decide whether a hygienic, fixed appliance can be placed without opening the bite. If not, a removable is indicated. Last, but by no means unimportant, the vitality of all pulps should be established and the teeth given a thorough prophylactic treatment.

Having made the diagnosis, we are better qualified to proceed with the design and the construction of the bridge. Just as the automotive mechanic understands the motor and its component parts with their individual functions as related to the function of the assembled motor, so also should we understand the masticatory apparatus, its elements, and their structure and functions, individually, collectively and relatively.

After a study of the foundation or body of which the abutment tooth is a part, let us consider the types and indications of the various attachments, pontics and connecters. The intermediary connection between the abutment tooth and the pontic of a dental bridge is called the attachment, be it for a fixed or for a removable appliance. The ideal has certain qualities that should be embodied, as far as possible, in all our attachments. As time does not permit amplification, they will only be enumerated. First among these in importance is pulp conservation; second, the least amount of tooth destruction consistent with extension for prevention; third, sufficient mechanical retention to withstand the displacing forces of continued and successive stresses; fourth, restoration that will restore the tooth to its normal form; fifth, simplicity of preparation and construction; sixth, safety, during preparation, to the paradental tissues; seventh, esthetics; eighth, easy fitting and placing.

The function of any attachment is twofold: retentive and prophylactic. It must hold the bridge proper to the abutment teeth, at the same time preventing injury to the tooth and its surrounding tissues. Since the types of abutments and the conditions under which they are found in the mouth vary greatly, it is necessary to use attachments to meet these varied demands. In certain cases, weaker types will suffice, while in others the strongest will scarcely fulfil the requirements.

The attachments at our disposal are

of two general kinds, inlays and crowns. Of the inlay group, the two surface types are considered the weakest and are used only in places where there are no dislodging forces and where the inlay is to receive a rest or lug. It is not used when a soldered joint exists between it and the pontic. In exceptional cases, it may be used with a soldered connection if the opposing arch carries an artificial removable denture. Moreover, when the abutment tooth is extremely short, a two surface inlay should not be used under any circumstances.

The next stronger type of attachment is the three-surface type. These attachments may be used with soldered joints or connections provided the tooth is of sufficient length occlusogingivally. It is important to have sufficient surface contact between the gold casting and the tooth structure to obtain a tensofrictional grip.

Should the stress of occlusion or the span or type of tooth demand a stronger type, the next choice is the three quarter crown. This is an ideal preparation and can be used almost universally. It meets all the requirements of an ideal attachment. Our debt to Dr. Tinker is immeasurable. In its present state of refinement, due to his efforts, we have an attachment that frees us from the constant dread of pulp involvement. Its employment makes it unnecessary to encroach on the pulp in order to obtain mechanical retention. The small amount of tooth structure removed makes possible thin castings of hard gold. With this attachment, the danger of thermal shock is reduced to a minimum. The beveled margin at the gingival is more practical than a pronounced shoulder, since it is easier to prepare and involves the removal of less tooth structure than when a shoulder is cut. This type of attachment is also highly esthetic, since its margins are not more evident than the margins of a typical mesiodistoclusal inlay. Finally, it does not require a superdentist nor a superdegree of technical skill to do this type of work. The instrumentation and technic are quite simple, bringing it within the scope of every man. At this time, the so-called "slice" preparation might be mentioned.

Occasionally, even the three quarter attachment is deemed too weak. We are then compelled to resort to the next stronger type, the full crown. This is by far the strongest attachment that we have, but it should be used only when the others fall short of the necessary requirements. It is indicated where the tooth is very short occlusogingivally or where the coronal portion of the tooth is imperfect in structure, form or position. The teeth most commonly employed are the second and third molars and often the lower first bicuspids.

Our next consideration is the pontic. The construction of pontics or so called dummies has received less careful study and less time than any other part of the dental bridge. Pontics may be constructed of gold or porcelain, or gold and porcelain. The former two have their limitations, but it is the gold-porcelain combination type that is more general in its application. Since a pontic is the artificial substitute for the lost natural tooth, it follows that the ideal pontic should simulate the natural tooth as closely as possible.

Up to a very recent period, we placed bridges the pontics of which consisted of a porcelain facing ground to fit a scraped cast, then backed, soldered and assembled in one operation. Little or

no attention was paid to the occlusion, contour, cusp relations, contact points, embrasures or hygiene. No wonder that, in the course of a year or more, these cases would return to us in such a condition as justified some the diatribes launched against American dentistry. We must not lose sight of the fact that the pontic is the prime objective of the bridge. We have had pioneers in this field who spent a great amount of time and effort in pointing out the essentials of a permanent, esthetic and hygienic pontic. Let us consider these essentials, briefly. In the first place, no porcelain, unless it has been glazed previously, should come in contact with the mucosa. Unless reglazed, ground porcelain will absorb the fluids of the mouth, which fermenting act as an irritant to the mucous membrane. Glazed porcelain is not only impervious to moisture, but, being highly glazed, it presents a smooth, nonirritating surface to the tissues with no danger of mechanical irritation. We will find that a tip of porcelain, convex in all directions and brought into close contact without pressure on the tissues, after a few years will be clean and the tissues surrounding it normal.

It might not be amiss to designate some of the dangers encountered with this type of pontic. Generally speaking, there are two types employed: the root and the plain tip. The former is placed within the alveolar socket, the latter in contact with the crest of the ridge after it has healed. A few years ago, the possibilities of the porcelain root created great enthusiasm. We all tried it, and some of us without careful study, I am afraid, placed it indiscriminately. Not long after that, we encountered trouble. Secondary infections, recessions and monument-like cones stared us in the face. Immediately the "anvil chorus" was sounded, the principle was "all wrong." As with everything else, we soon learned that this type of pontic had its limitations. We set about to find out what they were and, among other things, found that it was necessary to have a sound alveolar plate of bone; also that extreme care in extraction was essential in order not to injure the adjacent tissues. Moreover, the root could not extend into the socket to a greater depth than one-third its distance. Care had to be exercised not to have the porcelain impinge against the bone and to eliminate its use where there was an extensive pathologic condition. After recognizing its limitations and using it where indicated, we realized its full benefits.

In constructing a pontic of the baked tip variety, there are several points to be remembered: first, that the widest part of the pontic, mesiodistally, is through the contact points just lingual to the facing, and that the contact points are in gold and not in the porcelain facings; secondly, that the pontic is narrowed mesiodistally in its lingual half. This results in wide embrasures on the lingual surface, with a resultant reduction of the occlusal surface and stress. A ideal pontic tapers from the contact points to a gingival end. The tip of the porcelain rests on the center of the ridge or a trifle to the buccal side. The contour of the facing must always harmonize with the remaining teeth.

At this time, I wish to stress another phase, the selection and grinding of the facing. The edentulous space should not be filled entirely mesiodistally by

the facing. The pontic, mesiodistally, is widest in the gold just lingual to the facings. If the facing is as wide as the distance through the contact points, after soldering, the joint, instead of assuming a circular form, will be much wider buccolingually than the desired form. Should it be impossible to obtain a facing narrow enough, the grinding must be done at the expense of the buccal surface. Similarly, if the gingivoclusal length is to be shortened, it is done at the expense of the buccal and not by increasing the occlusal bevel of the facing.

One of the important things overlooked in the construction of a pontic is tooth form. How many of us have stopped to note the comparative distance between the buccal and the lingual cusps of a lower first molar and its greatest buccolingual diameter? Those who have will recall that, if the greatest buccolingual diameter measured 12 mm., the distance from the buccal to the lingual cusp point was about 6.5 mm., or nearly one-half. Yet how many bridges are placed on which the distances from cusp to cusp almost equal the greatest buccolingual diameter? Let me emphasize the significance of this arrangement as found in Nature. We are aware of the fact that doubling the diameter of a water pipe increases its capacity four times, while doubling the diameter of a sphere increases its content eight times. The same is true of a sphere. Consequently, an orange with a 4 inch diameter has four times the contents of one 2 inches in diameter. Similarly, doubling one dimension of a square will double the surface area, but doubling both dimensions increases the square area four times. We can readily draw the analogy existing between these measurements and the importance of proper occlusal cusp relations and occlusal surface areas.

Another point to stress is the importance of marginal ridges and grooves. Unless the marginal ridges are well formed and properly placed, a low-degree inflammation in the interproximal tissues will result. Grooves that are regularly found in teeth should be accentuated. Other supplementary ones are placed where they will aid the escape of food. The latter are usually cut through the marginal ridges from the central groove over into the lingual embrasures.

The final unit of the fixed bridge to be considered is the connecter or the means of uniting the pontic with the attachment. There are two types: the rigid or the soldered joint, and the flexible or the rest or lug type. The question is often asked: when is one type indicated and when the other? We are led to believe that the stress-breaker type of rest or lug should be used universally except where the span is too long or where the teeth are loose. We cannot lose sight of the fact that there is a certain amount of individual movement in teeth, but not to the degree claimed by some. Even when both attachments are soldered to the pontics, there is still a certain amount of mobility. To say that fixed bridges produce pathologic changes is not compatible with our clinical and radiographic findings. Although we place a removable restoration where it is indicated, we must admit that a restoration is efficient in mastication only in proportion to its stability during function. Hence, all other things being equal, the

fixed appliance gives greater service in masticating food.

An appreciation of the vital factors is of far more concern in partial prosthesis than an appreciation of the mechanical. More good bridges are lost because they were placed on poor foundations than because of the type of attachment used. Disregard of tooth form, absence of embrasures and improper occlusion will overcome any advantages of glazed porcelain, accurate castings or methods of retention.

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DISCUSSION

Albert P. Grunn, Chicago, Ill.: There are many types of removable bridges, some simple and some complicated. We find men who are absolutely set on one type or another and who seem to be sincere in their belief that they are right, and we find as many who advocate the fixed type of bridge and the elimination of nearly all removable appliances. Who can say that a fixed bridge that has stood the test of twenty or more years has been a failure? And who can condemn a removable type that has answered every requirement from the standpoint of masticatory efficiency? There are many problems that confront us in bridgework which make it difficult to determine the type of bridge to be built; yet if we study our cases from every angle, as Dr. Tylman suggests, taking advantage of the aid of the roentgen-ray, and observing the laws of physics and mechanics, we can achieve the success we desire, with a thorough understanding of what we are doing, because we have mastered the underlying principles that make success possible. The use of full mouth study models as an aid in diagnosis is a point worth remembering. In fixed bridgework, certain basic rules are fundamental to successful application, such as favorable conditions, good health, proper sanitation, sound mechanical principles, proper distribution of abutments favorable to stress and strength required, and many other which have already been mentioned. Of the two types of attachments, the cast gold inlay certainly has been a ray of sunshine to the dentist, making possible the placing of bridges on vital teeth where formerly employment of a crown and devitalization were imperative. The three-quarter crown casting has come to stay, and, when properly fitted, it seems to meet the general requirements for an ideal attachment. The semifixed bridge, with lug or rest at one end, has proved satisfactory in most cases. Inlay bridges, cemented at both ends, have proved unsatisfactory, except when the cavity preparation was deep enough to resist lateral movement of the teeth. I was glad to hear Dr. Tylman speak so favorably of the three-quarter crown casting as an attachment for bridgework. Many men are doing beautiful work in this line. When a full crown is indicated, either a cast jacket or, if a shell is used, a band of 34 gage pure gold is carefully fitted, the top split and bent down on top of the root, and an impression taken, articulated, waxed and cast. This makes a well-fitting crown and can be carved and contoured in the wax to reproduce natural tooth form. This type of crown, with proper root preparation, is preferable to the heavier 22-carat gold band of the old type shell crown, because of the snug-fitting pure gold band. The point of carving to reproduce tooth form is important, also the glazing of all porcelain coming in contact with the mucosa. The use of a removable or a replaceable type of porcelain facings makes it possible for every dentist to follow out this procedure. A polished porcelain tip will not close the pores, as we might be led to believe. I am glad that Dr. Tylman touched on the porcelain root, which caused trouble for many until they learned to bake it shorter. Overloading of abutments was another point well covered.

THE PARTIAL DENTURE PROBLEM: FIXED BRIDGEWORK*

By HART J. GOSLEE, Chicago, Illinois

THE problem of replacing missing teeth in the partially edentulous case is a problem only as far as the selection of the best method for the individual case becomes a problem.

In the replacement of missing teeth and in the restoration of impaired function, which always follows the loss of any number of teeth, from the single unit to the full complement, there is no one best method. Nor is any one single method, or line of technical procedure, applicable universally to all cases. Each case is a case within itself, and each case presents aspects and features so varying as to demand careful preliminary study before planning or building any type of partial denture restoration, if the highest degree of efficiency and of permanency is to be achieved.

In the application of any method of procedure from the most simple to the most complex, from the now almost obsolete vulcanite base carrying but a single tooth to the most ingeniously devised and skilfully executed modern type of restoration, carrying or replacing any number of teeth, some degree of mutilation or of destruction of the crowns of the remaining and supporting natural teeth follows.

The degree of mutilation or destruction varies largely with the method used, and untoward results, either at the time of building the restoration or eventually, follow as a sequence to the ravages of wear and stress. Thus, no method of procedure and no type of restoration is entirely free from some disadvantageous, questionable or objectionable features.

Any method of procedure, therefore, is primarily and necessarily but a choice of evils, and hence conscientious efforts should always be made in the selection of that one particular method which involves, requires or results in the least mutilation or destruction of the crowns of the remaining natural teeth from the time of building the restoration to the end of its period of service, and yet which will also seem to afford and insure a maximum of efficiency and permanency.

The selection of that one particular method of procedure which will best subscribe to these requirements is the problem which confronts the partial denture prosthetist today.

All methods now in general use have their respective fields of usefulness, but just which one method is best for the case at hand, from every point of view, is and must always be entirely a question of good, sound and honest judgment on the part of the dentist himself.

In making the selection, one must be actuated and guided not by the fantastic

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claims of those who may be interested in or who can visualize only one method of procedure applicable alike to all cases; not by those who can see only the possibility of a large fee, but rather by a working knowledge of all methods, and by the exercise of rational and honest judgment in all cases, and at all times.

Good judgment, therefore, is the keynote and the climax to successful achievements in the versatile and exacting field of partial denture prosthesis. And he who builds upon this foundation builds best for those who entrust themselves to his care, and best for himself in the end.

Of the various methods used in the replacement of missing teeth and in the restoration of impaired function, none offers a greater field of usefulness today than fixed bridgework. This method of procedure has withstood and survived the most vicious and tyrannical indictment, and the most abusive condemnation ever made, intelligently or otherwise, on or against any one line of effort followed or practiced in dentistry.

And yet fixed bridgework stands today in the minds of all fair-minded, unbiased and self-thinking operators and technicians, as one of the outstanding and most generally useful methods of partial denture restoration now at our disposal. I prophesy that the application of this method will remain a successful practice as long as reparative and restorative dentistry is demanded.

And just now, in view of the prevailing disregard of the value of the natural teeth and of their masticating efficiency as compared with that of artificial replacements of any type, and in view of the era of ruthless extraction, without any consideration of postoperative results, or of impaired health which must follow impaired function, with its influence on mastication, digestion, nutrition and metabolism, through which we are now passing, fixed bridgework is needed more today than ever before.

This statement is based upon the lamentable fact that more natural teeth are being lost prematurely today than ever before in the history of dentistry, and upon the sincere belief that replacements and restorations made by means of properly constructed fixed bridgework, used when indicated, offer and insure greater efficiency in the restoration of function than is afforded by any other single method of replacing missing teeth.

The latter statement rings true because masticating efficiency depends on the stability of all teeth functioning, whether they are natural teeth or artificial substitutes. Therefore, just in proportion as the natural teeth are firmly seated in their foundation or investing tissue, masticating efficiency is increased, and likewise, just in proportion as any type of partial denture restoration is stabilizing in functioning will the degree of its efficiency in restoring function also be increased.

For this if for no other reason, when fixed bridgework is indicated, and when it may be constructed properly, no other method will answer the same purpose, and, by the same token, where its use is contraindicated, any other method will be better.

In order that restorations of this type may further aid in the promotion and maintenance of health, they must be so constructed at all times as to subscribe to all of the requirements of mouth

hygiene and sanitation. Failure to observe such requirements has been a common fault with much of the work of the past, and has been the cause of much just criticism. It is to be observed that a higher appreciation of these requirements is being evidenced in the work of the past few years.

Whenever it may not be possible, because of the size of the restoration or for any other reason, to so construct fixed bridgework as to afford every opportunity for sanitation, and as to make it possible for the wearer to keep the restoration as clean and free from deposits and accumulations as they may be able to keep the remaining natural teeth, fixed bridgework should not be used.

In a recent splendid article on the subject of periodontia by Dr. Paul Stillman, the following statement is made: "All forms of restorations for replacing missing teeth should be so constructed as to become a part of the therapeutic remedies necessary to restore health and function."

When we can so build all of our restorations as to meet these requirements, and when such restorations can be used with good judgment, and only when all indications are favorable is the employment of fixed bridgework a rational procedure, having a broad field of usefulness.

Any injury to the supporting teeth or investing tissues that may follow as the result of the partial immobilization of the teeth so used is no longer regarded as a burning issue, or an issue worthy of more than passing thought.

An abundance of clinical evidence furnished by restorations in the mouths of the peoples of the world for periods of usefulness varying from five to thirty-five years causes this aspect of the subject of fixed bridgework to be but a beautiful theoretical fantasy. Furthermore, it is highly probable that even the theory will be disproved by scientific and biologic findings in the very near future.

As has been emphasized previously, the successful application of fixed bridgework will be insured only in proportion as favorable indications and reasonable limitations are observed, and this requirement is next in importance to that of sanitation.

Heretofore, but little effort has been made to define clearly any line of demarcation between conditions in which this type of work is indicated, and those in which it is contraindicated.

Since the restoration, however large or small it may be, is to be securely and permanently attached to the supporting natural teeth, it is obvious that these teeth must necessarily do the work of, and withstand the stress imposed upon, the missing teeth to be replaced.

While Nature has so protected and supported the roots of teeth as to enable them to withstand some degree of masticatory stress beyond their own functional requirements, an unreasonable degree of over-burden will not be tolerated for any great length of time. Hence, the indications for the use of fixed bridgework must be governed entirely by the requirements of masticatory stress, and the stability, position, distribution or interrelationship of the abutment teeth are the controlling factors which determine the practicability and permanency, or the success or failure, of this type of restoration at all times.

Therefore, when the health, stability and distribution of the abutment teeth are favorable to the requirements of masticatory stress, this type of restora-

tion is indicated and may be used with every assurance of success. But whenever these conditions are not favorable, or are doubtful, some other type of restoration is indicated.

In the selection of the abutment teeth to be used in the application of this class of restoration, good judgment must be exercised at all times. While it is true that a fixed restoration supported by abutments of similar functional activity only is a more nearly physiologically ideal application, to associate the physiologically ideal with the artificial is travesty, and clinical experience, the greatest of all teachers, does not justify the unchallenged acceptance of this theory as an arbitrary or imperative rule.

Art may copy or simulate Nature in beauty and in many other forms, but art can never hope to reproduce perfectly, or restore, normal function. And while it is always laudable to seek the ideal, we rarely ever reach it in the artificial.

Artificial substitutes for the natural teeth come nearer to restoring normal function than anything else artificial, and fixed bridgework comes nearer than any other type of denture restoration or than any other restorative procedure known to the realm of art.

And yet, fixed bridgework, placed where indicated, subscribing to all of the requirements, and built with faultless technic, is not a 100 per cent procedure; nor is any other one method of replacing missing teeth. Nor do I believe that there is any place in science, in art, in medicine or in dentistry for the "100 percenter," excepting 100 per cent in honor and honesty, and in conscientious, unselfish endeavor.

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PARTIAL DENTURE PROBLEMS*

By A. ALFRED NELSON, Detroit, Michigan

IT is a fact to be lamented that the construction of partial dentures, though one of the oldest branches of our science, is attended with more or less uncertainty as to whether the results will be satisfactory to either the patient or the operator. Generations of effort have failed to place partial denture construction upon an absolutely scientific basis.

Today, the present status of practical partial denture construction is in as much of a chaotic condition as it was twenty years ago. This state is attributable not so much to a lack of definite information as it is to a mass of more or less harmful but plausible misinformation being given to the profession by sciolists—those camp followers of scientists, that we hear about. A sciolist is one who knows how little he has but refuses to admit it and thus when cornered for an answer states whatever comes into his mind regardless of whether it is correct or not.

Under the guise of progress, the virtues of the casting processes in connec-

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tion with partial denture construction are being grossly exaggerated and misrepresented. It is human to follow the path of least resistance, and when so-called new, simple and easy methods are advocated, many men whose experience is limited become enthused and apply these methods in their practice, with ultimate grief to their patients and their own reputation, owing to a disregard of fundamental principles.

I am referring particularly to these so-called one-piece partial denture castings, which make it possible to construct the entire appliance from one impression by casting, and thus do away with the making and fitting of separate parts and their assemblage by the so-called old methods. True, progress and saving in time are desirable, but it must be in harmony with fundamental principles or become detrimental, as is the case with this alleged panacea for the problems confronting us. Thus, a lack of knowledge of fundamental principles may well constitute the chief problem in partial denture construction, for many men.

Fig. 1.—Case involving loss of second bicuspid and first molar, calling for removable bridge.

Full denture construction has made great progress in the past few years and owing to one reason only—men gave up the idea of discussing technic and the petty differences existing between them and confined themselves to a discussion of the underlying principles. When these were established, instruments, appliances and materials were developed in harmony with their intended purpose in facilitating the application of the principles laid down. Definite technics in methodical sequence were then evolved.

Partial denture construction will progress only when the underlying principles are understood and technics evolved that embody these fundamental principles. Technic may vary in the hands of different individuals, under different conditions, but principles do not vary; they guide and control technic, and hence are more important.

A thorough knowledge of the underlying principles of full denture construction, particularly those relating to the kinematic problems involved and to the cause and effect of tissue changes, are essential to the successful completion of a partial denture.

In order to further analyze and discuss this subject intelligently, we must first establish a distinction between the so-called partial denture and removable bridge, because we so often deal with one or the other or a combination of the two.

The following definitions are axioms that should be borne in mind when planning a case, and if the meaning of the definitions are adhered to in the construction of appliances, better results will be obtained in either type of construction, regardless of whether the abutments are inlays, crowns, clasps or other frictional retentional devices.

Any structure which, through necessity, depends on the mucous tissues and their underlying bony structure for major or entire support is a partial denture and not a bridge, regardless of the material of which it is con-

structed. It must be so designed that it can be removed at will by the patient.

Any structure which depends on the abutment teeth to bear the major or entire burden of stress of mastication and is so constructed that it can be removed at will, is a removable bridge.

Therefore, according to my last definition, a case involving the loss of the second bicuspid and first molar (Fig. 1), utilizing as abutments the first bicuspid and second molar, is a removable bridge, pure and simple, regardless of the type of abutment pieces used. In any event, the major stress is carried entirely by the abutments, and little support is obtained from the use of the average saddle as constructed for these areas. Saddle support is dependable on area; consequently, the case under discussion, that of supplying a bicuspid and molar, having little area for saddle support, must of necessity depend on the abutments for major or entire support.

Fig. 2.—Case involving loss of many teeth, calling for partial denture.

Cases involving a larger number of missing teeth, and, hence, larger areas for saddles, and especially extension cases in which there is no posterior abutment, must of necessity be supported to a major extent by the mucous tissues and their underlying bony structure and to a minor extent by the abutments. Thus, this type of case (Fig. 2) is justly called a partial denture, regardless of the abutment pieces. If the major support is not borne by the mucous tissues, the stress on the abutments will prove excessive and thereby admit of more or less rapid loss of the abutment teeth. Surely no one will question that the conservation of abutments in these restorations is of paramount importance, and if this is so, the utmost effort must and should be made in this direction.

There is another and perhaps often more troublesome type of appliance to consider, namely, that type of restoration which is a combination of both bridge and partial denture. For example, in one of those typical lower cases in which the bicuspids are missing and the first and second molars remain, all of the teeth back of the cuspid or first bicuspid are missing on the opposite side. (Fig. 3.) This case is one in which the operator must depend on the abutments for major or entire support on the one side and tissue support on the other, because it is connected by a lingual bar. The specification for the construction of this type of case by the so-called new and easy method that I previously mentioned in the opening of this paper is very simple.

Fig. 3.—Case calling for both bridge and partial denture.

Take a plaster impression and bite; pour a cast of a special refractory material (which is not quite so refractory as claimed when

tested); set up on an articulator to an occlusion model; wax up the clasps, bar and saddles; set up the porcelain crowns or other removable teeth; carve and smooth the wax; remove the porcelains; invest; cast; trim; polish; insert in the patient's mouth. The patient smiles; you smile; your secretary collects the fee, and you dismiss the patient.

Now, what's wrong with this? First of all, the shrinkage of this one-piece casting is so great that we have a first-class regulating appliance. If we have not used adequate occlusal rests on the clasps, the case will settle in a few days, producing gingival irritation and loss of occlusion. The clasps are forced downward and out of position in relation to the contour of the teeth and provide considerable additional lodging places and retention for food débris. If we have used adequate occlusal rests, the side which has the short span or rather the two abutments is comparatively safe, but the other side with the extension saddle responds instantly to every stress of mastication, which is immediately transmitted to an abutment tooth, with the attendant consequences.

How can we, as members of this profession, really be scientific men and live up to the tenets of our science, when, instead of constructing an appliance that will function in harmony with the supporting structure, we construct one absolutely contrary to the principles of leverage as was done in the case cited. This intermingling of principles causes the death of the abutment tooth, with a trail of misery and ultimate loss.

At this time permit me to bring to your attention the work of a local man which is distinctly outstanding in this field of work. I refer to that chapter in Dr. Goslee's textbook relative to the stresses and strains, or in other words, the load each individual tooth will carry. If this law, and it may well be called a law, is put into operation in the construction of our work whether it be fixed or removable crown and bridgework, or if it be partial denture construction, it will result in a greater degree of success in either branch.

May I pay tribute to Dr. Goslee at this time? It affords me a great deal of pleasure to pay just tribute to a man in his own locality, for so often genius is unrewarded and unknown by those with whom it comes in daily contact. I say it gives me great pleasure, for it is the first time Dr. Goslee has appeared in an audience that I have addressed, to my knowledge, with the possible exception of when I was a student at Louisville, and *he did* the speaking, not I.

Another problem that demands consideration is that of impressions, for partial dentures are only as efficient, in direct ratio, as the cast over which they are made. Plaster of Paris, mixed to a thin consistency, gives us an accurate impression, which is absolutely essential for the construction of the metal framework. From this impression, we should follow the usual procedure to bring the case to completion, with the exception, that we should make provision and allowances for immediate rebasing of all extension saddles of the case with compound.

This immediate rebasing of extension saddles is essential so that the underlying structures may carry the stress of mastication. It is advisable to use vulcanite on all extension saddles so that periodic rebasing may be resorted to as absorption takes place. This vulcanite may ultimately be removed and replaced by a gold saddle, provided the other or more permanent part of the structure has stood up.

Under other problems that affect the

success of our work may be cited such facts as leaning abutments; binding or tension between abutments, and undue stresses upon the abutment teeth.

If the restoration does not do the work of the teeth it replaces, it is a failure. The restoration must restore lost masticating efficiency and thus protect the remaining natural teeth from overfunctioning. If it does not do this, it merely fills a void and is useless. Our problem, then, is to restore occlusion.

The mere fact that partial restorations are retained in the mouth by means of retaining devices is no reason why the laws of occlusion and articulation should be totally disregarded in the placement of the masticatory substitutes.

Traumatic occlusion is a problem that for years caused considerable trouble in full denture construction, and although experience is a great teacher, it seems, from the present day literature on the subject, that few men appreciated its influence on successful partial restorations, whether partial dentures or bridges of either type. In justice to the periodontist, it may well be said that he has appreciated its significance in his work.

The leaders of work in our field have been divided by two different conceptions or interpretations of the fundamentals involved in this problem. To quote from a recent publication by Dr. House[1] of Kansas City:

> At the very beginning of treatment, the dentist places himself in one of two distinct groups of workers. One group disregards all of the changes which have taken place in the forms of the natural teeth, in mandibular functions and in the articulating joint. These workers believe that the cusp forms of the teeth and the way in which the teeth are arranged control the movements of the mandible and that they may safely arrange artificial teeth by an arbitrary technic without regard to what the habitual movements of the individual patient may have been. They believe that by such a technic, they can establish an ideal function which will result in comfortable and efficient mastication. Long experience and extended observation clearly demonstrate that the efforts to establish ideal function without regard to asymmetries of horizontal movement, which may have developed in the individual and may have been continuous for years, result in continuous cuspal interference between the maxillary and mandibular artificial teeth which cannot be corrected without extensive grinding away of the cusps. This interference, unless relieved, causes continuous soreness of the soft tissue and destructive changes in the underlying bony structure. In an unsuspectedly large percentage of cases, interference of this character accounts for the continual grinding of teeth and frequent rebasing of dentures, which are resorted to in the search for relief.
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> The other group of dentists attaches a very high value to the changes of the forms of the teeth which occur in patients prior to the making of artificial dentures, to the changes in function which result from the changes in tooth forms and to the changes in the articulating joint which result from changes in tooth forms and in function. They believe in recording the mandibular movements habitual to the patient, in diagnosing the character of those movements and in arranging the teeth in such a way as to reestablish proper facial dimensions and the cuspal interdigitation and coordination necessitated by the mandibular movements habitual and peculiar to that person. Experience and observation show that arrangement of the teeth in this manner obviates the necessity for extensive grinding away of the cusps and frequent fitting of the denture, and reduces the soreness of the soft tissues and the destruction of the underlying bony tissues to a minimum.

What Dr. House states in reference to full denture problems can be applied with equal emphasis to the problems of partial denture. In the first group might be placed such investigators as

1. House, M. M.: Dent. Digest, September, 1925.

Bonwell, House, Hall, Campbell, Monson, Needles, Wadsworth, McCollum and Washburn. The latter group of investigators embraces such men as Walker, Gysi, Prothero, Frahm, Horner, Kerr, Hanau, Tench, Wright, Gillis and Sears, and lately Drs. Wadsworth, McCollum, Needles, Campbell and House have joined this group.

The thoughts represented by these two groups were the controversies of yesterday. As matters stand now, it may be safely said that our keenest thinkers and investigators have definitely alined themselves with the latter group.

We may safely presume that the basic principles appertaining to balanced occlusions are now fully understood and ready for application, though there may still be some disagreement on minor points. The science appertaining to balanced occlusions, balanced jaw relations and balanced articulation is an exact science today, just as exact as are physics and chemistry. As in physics and chemistry, we will have further development and progress without any immediate need of revolutionizing basic principles.

Do not think for a moment that I have forgotten myself by embracing, for any ulterior motives whatsoever, some new articulator religion; and don't assume that I possess that analytic mind of a genius who can decide on theory only. My decision has been arrived at after expensive and discouraging failures and hard study, and by observing others achieving satisfactory results where I had formerly fallen down. There was nothing left for me but to renew my efforts and do better. I would suggest that those in a position such as I was do likewise, for there is no further excuse for leaning on faith to decide an issue on balanced occlusions, etc., as has been in vogue.

While there is much to be found out in regard to the physiologic function of the masticatory apparatus, the mechanical function has been clearly worked out.

From the standpoint of balanced occlusion, we must build our case to conform to individual requirements for the best results under the conditions with which we have to contend, and these cases, in rare instances, will approximate the ideal. The requirements are governed by partly unchangeable existing conditions which do not permit of strict conformity to any type, norm or standard, such as the so-called ideal. There are several factors that enter into the control of the occlusions. Whether there is a predominance of any one of these factors, such as the teeth, is an open question.

The question of tooth control in movements of occlusion is a conception similar to that of the floating condyle theory, discarded some time ago by previous investigators in the realm of occlusion.

Recent investigators liken the anatomic apparatus to a machine—a machine of the gear type, in which the teeth are represented as the gears—and state that this machine is being planned for complicated action. Now the most important point in regard to the operation of machinery is purely mechanical, and in this respect it is well to call attention to the two factors which are continually being confused when comparing anatomic and mechanical apparatus. In the anatomic machine, the development of the various parts does not concern us when considering function only. Our

preeminent considerations are the parts already developed, just the same as in applying gears to machinery. The method by which the gears were developed or made is secondary, as long as they conform to definite specifications. Likewise, our study and development of the anatomic apparatus cannot help us any too much in the understanding of the complicated action of the fully developed parts. It seems more logical to study the developed parts individually and collectively in their coordinated relationship to the mechanism as a whole, if an analysis of their mechanical function is the object.

In investigating our problem in this way, the complicated action, previously referred to is a study of motion. This is known as the science of kinematics. Kinematics was introduced into dentistry as such by a recent investigator, not a dentist, who, after obtaining a comprehensive understanding of many previous dental investigators, approached the problem from a purely mechanical standpoint. This scientist had many advantages over purely dental investigators. In the first place, he separated physiology from mechanics. We can only appreciate what this means when we realize that the jaws in motion present a purely mechanical problem, and that when the mechanics is correct, the physiology or function is also correct, according to our present understanding of the subject. In this regard, we are indebted to this investigator for definite laws of articulation governed by the kinematics involved. The application and proven results of these laws have advanced our problem far beyond a study of the purely developmental stage of the parts involved.

For the past three years I have handled the problem of balanced occlusion in partial restorations as I would in full denture construction, on the basis of first establishing the jaw relationships as they exist in the patient, and by means of the face-bow and records, transferring them to an instrument that will allow of condylar path adjustments. In other words, I reproduce in an instrument the error or errors that exist in the patient. Then, and only then, am I qualified even to hint at the correct alinement of the teeth of the case in hand.

Basically, the problems of balanced and unbalanced occlusion in full denture work are closely akin to those of crown and bridge and partial denture work, and hence, because of this kinship, it is incumbent on us thoroughly to study the problems as they have been advanced in full denture construction and, from this basis, work out our peculiar problems along this line.

Metallurgical and physical properties of the materials which we must use in the construction of our work constitute another problem. Inferior materials, although apparently cheap, are expensive, and I cannot emphasize too strongly that the highest priced materials are not necessarily the best for a given case.

Members of the profession, owing to ignorance on the subject, use poor and improper material in the construction of cases. This is often due to the fact that the profession is misled by essayists and clinicians who are directly or indirectly related to manufacturers and advocate certain qualities for products which are either deliberately misrepresented, or for which unwarranted claims are made.

To overcome this lack of definite information by the profession, the Bureau of Standards, through the cooperation of L. J. Weinstein, Sc.D., has investigated and conducted an exhaustive research on the physical and chemical properties of the materials used in our work. A large portion of this research has been completed but is unavailable to the profession at large in the form that I believe desirable and that is by calling a spade a spade and branding the materials with their proven qualities. This will come eventually.

CONCLUSION

I would suggest that interest and enthusiasm be aroused in the profession to assist morally the investigators who are laboring with our problems. The proper planning and classification of the case at hand; a thorough knowledge of the laws of articulation and occlusion, and a knowledge of the physical and chemical properties of the materials used are, to my mind, the three outstanding requisites to a solution of the problems confronting us.

DISCUSSION ON THE PAPERS OF DRS. NELSON AND GOSLEE

G. M. Hambleton, Chicago, Ill.: A number of years ago I heard Dr. Goslee say that if a man had good common sense he would make a good dentist. Since there are no hard and fast rules in the partial denture construction problem, it affords the dentist ample opportunity to exercise all the good judgment he may possess or can cultivate. If we can remember the cardinal principles as set forth in these two papers, we will not go far astray, and our problems will have been made much easier. As Dr. Goslee mentions, little effort has been made to define clearly the line of demarcation of types of work when indicated and contraindicated. It seems to me that when we do listen to indications and contraindications, we must also weigh the good judgment of the operator and compare it with whatever clinical experience we may have at our command. During the last year or two, I listened to a paper on indications for fixed and removable bridgework. As I remember it, the statement was made that a fixed bridge was never indicated from one superior cuspid to another, as it would not be successful. Just what was meant by successful I do not know. Recently, it was my privilege and pleasure to take care of a patient who presented an upper fixed bridge from cuspid to cuspid. It was placed there by one of the members of our society. This bridge had been in the mouth for more than thirty-two years and was still giving excellent service. He had been advised by a "100 percenter" to have all his teeth out. In my judgment, I could not see a tooth that should be extracted, and neither could one of our leading extractors. I also had the pleasure of telling the operator who placed this bridge that I had seen it and knew what good service it was giving. I want to endorse what Dr. Nelson has said concerning the abuse of cast partial dentures and also the abuse of cast clasps. Many partial dentures are being placed in mouths with cast clasps, making the denture amount to nothing more nor less than a fixed bridge. Yet these men would never think of putting a fixed bridge in the same case. There is another use of the partial denture that I believe is quite common practice and is questionable. That is the use of a partial lower against a full upper denture. This use of the partial denture calls for all the good judgment we may possess. I am convinced that there are many partial dentures operating against a full upper that are hooked on or around one tooth or two, three or maybe more teeth which are very injurious not only to the tissues of the lower mouth but also to the tissues of the upper. In how many partials used in this way is the occlusion balanced and kept that way? I feel that the partial denture, when properly constructed, is one of the most satisfactory things that we can construct. One of the things that I try to do for my patients is to emphasize to them the necessity of keeping that denture scrupuously clean. I show them. I show them what kind of brush to use and how to use it and try to get them to use some denture cream and, once or twice a week at least, to clean it with ordinary baking soda, as this makes it sweet and clean. That gets the patients to work along with you until they

have passed the adjustment stage. I also have them wipe the supporting tissue with a soft cloth.

Loren D. Sayre, Chicago, Ill.: There has been less attention paid to the making of satisfactory partial dentures than to the fixed bridge problem. We have gotten along with more makeshift partial dentures. In the past few years, we have turned to the real things in partial denture work. Dr. Nelson has touched strongly on traumatic occlusion. I think that is one of the greatest difficulties we have to overcome with this work. That, however, is not all. Frequently, in the case that requires partial dentures, there is everything the matter with the mouth. In many cases, in order to overcome these conditions, you necessarily have to remove all the teeth and make full dentures. We have to take these things as we see them and make the best of them that we can with the knowledge we have at hand. I think the castings and large pieces have received more than their share of criticism tonight. I, in the past, have been quite skeptical about them. In the past year and a half I have devoted more of my attention to that type of work. As I use them, I find that I improve in my technic and my understanding of the methods used, and have met with success. We must use judgment in placing these cases. In cases of recent extraction in which we expect a great amount of settling, we must use our judgment as to the teeth that we clasp, the places that we clasp and the sort of retention that we use. The cast clasps that are being used and are capable of being used by men who understand them are not very different from our ordinary clasp. Our clasps, though, need not be so strong that it makes a fixed bridge of the piece. The intention of the clasp is to steady the denture, to keep it from moving with the movements of the muscles of the mouth, and the food we are eating. It is not the intention to hold it from lateral movement at all, but merely to steady it. One piece castings can be made, and many are made, that have vulcanite attachments, so that they can be rebased, the same as though constructed in units of a metal framework. The shrinkage and the contraction of the one-piece casting is no greater in many instances than it is in the solder in uniting the several parts of the framework. My experience is that the one-piece castings have a place in our partial denture work today. The settling of the tissues under the saddles, particularly the small saddles, are in ratio to the size of the saddles. The smaller the saddle, the greater amount of settling we have of the denture; and the larger the saddle, the smaller the amout of settling of the denture. In any event, it is almost impossible to divide the stress between the remaining natural teeth we can clasp to and the movable tissue. We have merely the compressibility of the peridental membrane in comparison with the mucosa of the gum tissue, then, and the peridental membrane certainly has not the compressibility that the soft tissue of the gum has.

Stanley D. Tylman, Chicago, Ill.: I am reminded in this meeting of an incident that occurred in Germany some years ago. They had a convention of medical specialists. One professor was introduced to the other. Professor Schultz met Professor Schmidt. "What is your specialty, professor?" asked the former. "Mine is the eye." "Which eye?" This is analogous to our contention as to whether we should use fixed or removable bridges. From specialization, we are coming to standardization. Where would we be in the motor industry if we did not have the various parts of motors standardized as to structural form and function? There is no valid reason why we could not put partial dentures on the same basis. Once we have determined what the standardized forms and functions are, we can work from a common starting point and work out our indications. The object of any partial restoration is to restore structural form and function. There seems to be some confusion as to what a partial denture means. To me, a fixed bridge is also a partial denture. Therefore, fixed bridgework comes under the head of partial denture work. The word fixed covers fixed bridges and the word removable covers the plates and the removable bridges. What is the difference between our plates and removable bridgework? No difference, except in their form of attachments. If we are going to work from a standardized basis, we must find out the structural form of our bridges. What are the elements that go to compose this structure? A motor consists of certain parts which, when assembled properly, will perform certain functions. The same is true of the bridge. Each part must have its correct shape, which must be properly interrelated with the next one, and all these correlated will give us a functioning whole. First of all is the foundation.

Tonight, we have been considering bridges or partial dentures as something extraneous to the body. We have not gone beyond the working models. The prime thing to consider is the human body. That is one of the most important considerations. Let us decide whether the patient is in a suitable condition to receive a certain type of restoration. The general systemic condition may be such that even if the abutment teeth are favorable, we should rather extract the teeth and place a full denture. After we have considered the patient from this standpoint, let us concentrate on the mouth. Find out what the conditions are, whether they are normal and healthy or not. Next, let us focus our attention on the teeth that are to be the abutments. Most of the slides we have seen, no doubt were shown assuming the abutment teeth were normal. However, nine out of ten cases are not normal, and under these conditions we must decide what type is indicated. Let us consider the other element of a fixed bridge, the abutment. Is it, first of all, in a healthy condition? Does the number of abutments compare favorably with the number of missing teeth? Consider the length of the root, the length of the crown, the attachment of the periodontal membrane, the strength of the alveolar process. The type of attachment used depends greatly on the gingivoclusal length of the coronal portion of the tooth. These are some of the things to consider in deciding on a fixed or removable appliance. Let us assume that we have two bicuspids missing; the cuspid and the molar being in a normal state, but the lower teeth out of normal position. There is a supraclusion in the lowers, reducing the space in the upper arch. This relation of the lower to the uper arch usually contraindicates a fixed partial restoration. Another thing we must not overlook, as Dr. Goslee has shown, is the distribution of the abutments. The position they occupy in the arch is very important; not distribution alone, but the capacity the abutments have for bearing stresses of mastication. This is determined largely not by the length of the root, but by the amount of attachment of the periodontal membrane between the root and the process. Furthermore, what is the direction of the long axes of the abutment teeth? There is a diagnostic difference if the long axis of one tooth is not practically parallel with the long axis of the other tooth. An unfavorable finding may decide in favor of a removable appliance. Another important element is the attachment. I shall not go into this factor because, as Dr. Goslee stated, we are not considering attachments. I merely wish to say that the size and the condition of the tooth determines the type of attachment used. The next essential is the body, or the suspended part of the dental bridge. More failures can be attributed to improper occlusal surfaces than to any other factor. It is not so much a question of fixation or removability as of tooth form. More teeth are lost through leverage and traumatic occlusion than through poorly fitting gingival margins. Since the abutment teeth may be called on to bear stresses other than those which they were originally intended for, we must minimize the occlusal resistance by reducing the occlusal surface of the pontics. Doubling the diameter of a pipe increases its capacity four times. You buy a 2-inch orange for 5 cents or you buy one 4 inches in diameter for 10 cents. You receive four times as much value in the 4-inch as you do in the 2-inch orange. The condition is analogous with occlusal surfaces. When you double both diameters, you have increased the surface four times. In other words, you have increased the possible stress on the abutment teeth by that much. Try to assist Nature by reducing the surface area by making wide embrasures. Accentuate natural grooves, and cut supplementary grooves through the marginal ridges. Dr. Goslee has mentioned the fact that stability is one of the main factors in the efficiency of a denture. Quite true; the more stable an appliance is during function, the more nearly do we simulate natural conditions. However, let us not confuse stability with rigidity. Whenever possible, try to segregate teeth into their respective functional activities. One slide was shown in which the second bicuspid was missing. The restoration advocated was an attachment on the molar without any support anterior to the bicuspid. We believe that a support should exist at both ends of a fixed appliance. An exception is sometimes made in the anterior region, when a lateral is missing, and where we have a good cuspid abutment and a favorable bite. In all other cases, we feel that a support is indicated at both ends. Otherwise, the leverage will be too great for the tissues to withstand, and sooner or later a tipping of the abutment and a slightly darkened area in the radiograms

are apparent. Moreover, it would assure better function if the pontic were rigidly attached to the first bicuspid abutment and a movable rest put in the molar attachment. This confines the two bicuspids to their proper buccolingual movements without interference from the molar. What are some of the indications and contraindications for fixed or removable bridges? Often, the contraindications for an upper fixed bridge are overcome by the fact that the opposing arch is a partial denture; in other words, the stresses to be exerted against the upper appliance have been reduced to a minimum. An indication for a removable appliance is a close bite resulting in insufficient space to allow for sanitation; also short teeth that do not allow sufficient tooth structure for a firm and strong attachment. Nor is it safe to use a lateral incisor as an abutment when two or more teeth are to be restored. Malposition of an abutment is another determining factor in the selection of the type of bridge to be used. A word or two regarding the removable partial dentures: Our removable partial dentures can be synthesized in the same way as our fixed partial dentures. In the removable dentures, we have the same foundation, that is, the human body and the mouth. The abutment teeth are considered in the removable as well as in the fixed. We have the attachments or retainers, as in the fixed. There are two kinds of attachments in any kind of removable work, the direct and the indirect retainer. Any appliance that exerts its retentive force directly at the point of application is a direct retainer. Any attachment that exerts its retentive force remotely from the point of contact is an indirect retainer. All removable appliances should be so constructed that, with the use of direct retainers, there is still a tendency for the denture to drop or to raise, this tendency to be offset by the use of indirect retainers. Wherever a saddle is used as a basis for a removable partial denture, there should be some form of stress breaker between the saddle and the direct retainer. If we make the retainer so rigid that when the denture moves, the movement is transmitted to the abutments, to all intents and purposes we have a fixed partial; sooner or later, we shall have trouble.

Dr. Nelson (closing): Drs. Hambleton, Sayre and Stillman spoke about the abuse of partial dentures and of cast clasps, to which I agree. As to the questionable procedure of using a partial lower with a full upper, that is a condition which is influenced largely by the fact as to whether or not occlusion is maintained in the partial denture when in contact with a full denture in the upper jaw. If occlusion is not maintained in the partial lower, then the retention of the natural teeth, particularly the six anteriors, will do damage to the alveolar structure of the maxillae. Cleansing is essential. It is suggested that surgical solution of chlorinated soda (Dakin's solution) be used. Mention was made of the lack of attention being given to partial dentures. I think that we should give a little more attention to this subject; and, for that reason, I ask that the men become more enthusiastic and study the work that Dr. W. E. Cummer, of Toronto, Canada, has been doing, as he is the only research worker on the North American Continent at the present time who is doing really constructive research work along the line of partial denture reconstruction. As I stated in my paper, traumatic occlusion is the greatest destructive factor we have to deal with in considering the various types of structures placed in the mouth. Some of you men did porcelain work twenty-five years ago, but something happened. It fell by the wayside. I have seen samples of this work made at that time which are far superior to those being made today. The texture and homogeneity of the porcelain were wounderful. Why then, did your porcelain work fall by the wayside? Because you paid no attention to balanced occlusion and articulation at that time and largely because of the fact that less attention was paid to the dental anatomy of the part that you were inserting in the mouth. If you will pay more attention to the balanced occlusion peculiar to the individual patient and to the dental anatomy in placing structures in the mouth, you will have greater success, regardless of the type of structure that is used. We have had trouble with everything in dentistry from full dentures to the complete set of natural teeth in the mouth, and all because something was lacking in the dental anatomy and kinematic field of the work involved. Now, to my mind that is the crying need of today. It is the fundamental function of the dental school to teach dental anatomy just as the sculptor is taught. He spends the major part of his time in studying not what kind of stone or what kind of chisels to use; that is of

slight interest to him; his chief interest and major problem is in studying the human body, or the animal body in its various postures and the relations of the various muscles to one another in these various postures. Then he spends the remaining time on the stones and chisels he is going to use. He doesn't have to have an animal or human being stand in front of him to design it in stone. He can do it in his mind's eye. We dentists—how many of us can carve a first molar? We can't even tell what the typical lower molar is. I doubt that ten men in the room can do it. We are trying to restore something, and we don't know what we are trying to restore. The clasps, as stated, are intended for retaining devices. These large one piece castings are really regulating devices and not dentures. We have yet to see a case in which shrinkage is not apparent. The remark was made that the soldering of the assembled type of construction, to a large extent, has as much contraction as the one-piece casting. If we have to span a large gap with the solder, we do have contraction, and this contraction increases in proportion to the size or number of gaps to be spanned. If any of you have studied the research work that the Bureau of Standards at Washington is doing in cooperation with Mr. Weinstein, you will find that we don't really appreciate the amount of contraction and expansion that actually exists in our castings. You can snap these large one piece castings into place, and all that. Examine these cases radiographically and check them up periodically, and you will find a very decided thickening of the dura around the teeth. Examining the cases from this standpoint, you are not so likely to say that they are 100 per cent successes. I don't doubt a bit that these ten to fourteen tooth bridges with four or five abutments that have been in the mouth from twenty to thirty-five years are as good as Dr. Goslee said they were. Possibly the man who constructed them deserves all the credit, and possibly the patient was a good tobacco chewer and he may have chewed them into a balanced occlusion and thus distributed the stress of mastication evenly. Did you ever look in the mouths of children? I mean from the time the deciduous teeth are erupted until the permanent teeth start their process of eruption. Up to that time, there is usually no factor influencing the positional relationship of those deciduous teeth. We usually find, in a great many cases, balanced occlusion. Orthodontists say we don't have it in adults, but that is no reason for saying we couldn't have it. If we had balanced occlusion, the teeth would be practically self-cleansing and would take care of themselves, and a great deal of our worry would be eliminated. As I said before, I wish we could arouse a little more enthusiasm and give greater evidence of our moral support to those investigators doing this kind of work. It is remarkable when you think of the work Dr. Cummer and Mr. Weinstein have done. They have spent their own fortunes doing this work and have given it to the profession. Someone spoke about the health of the patient being an influence on the type of structure placed in the mouth. That is true. Patients exhibiting marked calcium deficiency disturbances naturally are in a class by themselves as regards dental treatment. In a case of this kind with apparently all teeth condemned, it is not so much a question of vital or pulpless teeth as it is the removal of the worst infection and the temporary retention of the remaining teeth. No man can make full dentures where there is no cortical layer of bone and be assured of any reasonable degree of retention for any period of time, owing to the shrinkage. The absorption is so great that he would have to have the patient in his office practically all the time, rebasing. Thus, in this type of case, it is not always desirable to extract all the condemned teeth but rather to retain the least harmful and use them for abutments for retaining dentures, such as clasps, and construct an appliance that will give the patient some usefulness until such time as the calcium deficiency is cleared up and the osseous structure has shown evidence of formation of a cortical layer. Ultraviolet radiation is very beneficial with proper systemic treatment.

VINCENT'S AND OTHER ACUTE SURFACE INFECTIONS OF THE MOUTH*

By ARNOTT A. MOORE, D.D.S., Buffalo, New York

THE importance of the acute surface infections of the mouth is shown by the marked local and general symptoms which they produce. The patient is very toxic, with a temperature from 100 to 105 F., a rapid, weak pulse, and a pronounced general malaise. The urine usually shows evidence of an acute infection such as concentration and the presence of varying amounts of albumin and casts. Locally, there is pain, swelling, fetid breath, and, usually, more or less neck and glandular involvement.

The oral surgeon, owing possibly to his being in closer touch with the physician, is often called in these cases. His point of view naturally differs from that of the periodontist in many ways. He is operating most of the time and is apt to be more radical in his attempt to get speedy results. He is accustomed to handling serious infections, but not in the comparatively leisurely manner of the periodontist. Again, as soon as the case has passed the acute stage, he does not as a rule see it again. Therefore, in justice to myself, I wish it understood that the point of view in this paper is that of the oral surgeon and not of the periodontist.

The infections here considered will be Vincent's, streptococcic, mixed, saprophytic and pneumococcic. The last two mentioned are quite unusual and are not often seen. There are many other types of acute surface infections, but it was thought inadvisable to attempt their discussion at this time.

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 28, 1926.

EXAMINATION

The first step in treatment of acute surface infections of the mouth is a careful examination, both local and general. The condition as regards temperature, pulse, respiration and urine should be checked. Locally, the mouth, throat, neck, submaxillary and sublingual glands and the cervical nodes should be examined carefully in order to ascertain the course to be pursued in the treatment of the disease.

DIAGNOSIS

Having determined the amount of local and general involvement, the next step of importance is the differential diagnosis. Smears should be taken separately from sloughing areas, from beneath the free margin of the gums, and from the throat. It is recommended that the material for these smears be obtained by means of a small platinum loop rather than with swabs. They may be stained or examined under the dark field. If staining is the method decided on, Loeffler's methylene blue, eosin or Cahn's India ink method are recommended. In case

there is any doubt after the microscopic examination of the smear as to the identity of the infecting organism, cultures should be taken and a pathologist's opinion obtained. There should be no hesitancy in calling for consultation whenever necessary.

TREATMENT

The treatment of acute surface infections of the mouth should be both local and general. The latter should be in charge of a competent physician and should include general therapeutic measures such as complete rest, correct diet and attention to the bowels. As a general rule, the diet should be soft and should not contain any large amount of raw fruit or uncooked starches. In the case of saprophytic infections, it is well to leave proteins out of the diet as much as possible. Complications of a general nature must be met by the physician as they arise and cannot be discussed here.

Gentleness should be the keynote of the local treatment and, therefore, the tissues should not be disturbed any more than is absolutely necessary. In cleaning the mouth and teeth, cotton swabs, rather than a toothbrush, are used, trauma incident to prophylaxis being thus minimized. As tissues may be injured chemically as well as mechanically, the choice of the antiseptic to be used is of great importance. Many antiseptics are injurious to body tissues. These must be avoided. The antiseptic of our choice must kill or interfere with the growth of bacteria and must not coagulate albumin or interfere with phagocytosis. Preferably, it should be water-soluble and of such a nature that it will not be decomposed in the presence of serum or the débris found in acute infections. An antiseptic having been chosen which meets these requirements, it should be applied with the utmost gentleness to the affected parts while the infection is acute. Sloughs should not be disturbed nor should the swollen or irritated tissues. The use of swabs or applicators is recommended at this stage, whereas, later in the course of the disease, the antiseptic may be injected into pockets and under the free margin of the gums by means of syringes with blunt-pointed needles.

VINCENT'S INFECTION

The most common, and probably the most important, of the acute surface infections with which we have to contend is Vincent's infection, sometimes called trench mouth. This disease is technically a mixed infection of Vincent's spirochetes and *Bacillus fusiformis*. Vincent's infection is generally supposed to be a surface infection. I do not agree with this, for the following reasons: (1) the presence of glandular symptoms; (2) recurrence of the disease after treatment and negative smears; (3) death of the tooth pulp during treatment, and (4) response to general treatment. (The foregoing is clinical evidence and has not been worked out in the laboratory.)

The bacteria mentioned above attack the soft tissues of the mouth, throat, and nasopharynx, and, later in the course of the disease, the submaxillary and sublingual glands and the cervical nodes, producing the condition known as Vincent's infection. The disease is characterized by considerable induration, sloughing and very rapid progress. The breath is fetid, and there is more or less pain in the teeth, gums and neck glands. The general symptoms are rather pronounced, the patient being toxic, with a marked general malaise

and a septic temperature ranging from 99 to 105. The neck glands are always more or less involved in acute Vincent's and the treatment of the case should be regulated with that in mind.

The diagnosis of Vincent's disease is always made by means of the microscope, the smear showing large numbers of Vincent's spirochetes and *Bacillus fusiformis*. There are always stray bacteria present, but these are greatly outnumbered by the strains mentioned. Care should be taken not to confuse Vincent's spirochete with *Spirochaeta pallida*, and, if there is any doubt as to the identity of the organisms, they should be examined under the dark field.

The antiseptics recommended for use in Vincent's infection are acriviolet, arsphenamin in glycerin, and a weak solution of ammonium fluorid. Any of these are gently applied by means of swabs while the infection is acute. My method is to use acriviolet in a 1 per cent solution twice daily until the acute symptoms and sloughing have subsided; then, to alternate occasionally with the arsphenamin in glycerin, or the ammonium fluoroid solution, as bacteria are apt to become immune to an antiseptic if used continuously. The mouth wash used is of great importance, a 1:5,000 solution of mercuric chlorid in hydrogen peroxid being recommended. During the acute stages, the teeth should not be cleaned by the patient, as, every time a hemorrhage is produced, there is more pabulum for the bacterial growth. After the acute stage is passed, a 0.5 per cent solution of tannic acid in alcohol acts as a very efficient astringent and stimulant to the tissues involved. The general treatment is as outlined above with the exception that aluminum subacetate compresses (from 2 to 4 per cent) reduce glandular symptoms to a marked degree.

STREPTOCOCCAL INFECTION

The clinical appearance of an acute streptococcic infection of the soft tissues of the mouth is quite different from that of Vincent's infection. The tissues are a cherry-red, particularly the gums, and marked sloughing is unusual. There may or may not be a discharge of pus from the gum margins. Gentle pressure at these points will usually disclose some. There is usually considerable pain and more or less neck involvement. The streptococcus may be hemolytic or nonhemolytic. If it is the former, it is well to use hot mouth washes and only apply the antiseptic being used once daily for the first three or four days. In the case of infection by a nonhemolytic streptococcus, hot washes are of no particular value, and the antiseptic should be applied as often as is practical. In either type of streptococcus infection, the following dyes are recommended: acriviolet, 1 per cent; neutral acriflavin, 1:1,000; mercurochrome-220 soluble, 2 per cent. It is well to apply them under the free margin of the gums with a syringe and blunt needle and also to all the soft tissues of the mouth and throat. General symptoms should be treated as they arise. Operation while the infection is acute is to be avoided if this is at all possible.

MIXED INFECTIONS

It is rather difficult to discuss mixed infections in this paper, as they are many and varied. Briefly, their course may be rapid or slow, depending on the type and virulence of the infecting organisms and how well they grow to-

gether. Mixed infections of a rapidly progressive type require constant attention. Complications should be expected and serious attention given to the slightest indicative symptoms in order to forestall them if possible. An efficient antiseptic, such as acriviolet or mercurochrome-220 soluble should be applied at least twice daily, and, whenever possible, a specific for the predominating organism should be incorporated in the mouth wash.

PNEUMOCOCCUS INFECTION

In the case of acute pneumococcus infection, the local symptoms are not so much in evidence. The soft tissues have a grayish look and there may be a considerable discharge of pus. Differential diagnosis is made microscopically. The local treatment consists of applying quinin sulphate, a specific for pneumococcus, to the tissues involved, with swabs and syringes, alternating every other day with acriviolet. The mouth wash recommended in acute pneumococcus infections is the hydrogen peroxid-mecuric chlorid formula given above. Neck symptoms in this type of case are unusual.

SAPROPHYTIC INFECTIONS

Saprophytic infections of the mouth have almost the same appearance as the pneumococcic. The odor is unmistakable. The gums are pale and grayish, with necrotic mucous membrane around their margins in the earlier stages, and sloughs with exposed bone denuded of periosteum in the latter stages. Neck symptoms are unusual in acute saprophytic infections. In the treatment of these infections, it is best to use a very mild mouth wash as the vitality of the tissues is low and strong drugs are liable to produce more sloughing. The official antiseptic alkaline solution is recommeded, it being mildly antiseptic and harmless to tissues. A 10 per cent solution of ichthyol daily, alternating with a 1 per cent solution of acriviolet, produces very good results. There should be no operating under any circumstances during the acute stage of a saprophytic infection.

The complications that may follow in the wake of these acute surface infections of the mouth may be divided into local and general. Locally, there may be large sloughs and sequestration, death of teeth and their subsequent abscessing, and such excessive swelling that breathing is made difficult. General or distant complications may be: (1) *metastasis;* for example, in the ear through the blood stream, in the lung through inhalation, and in the intestine through swallowing bacteria; (2) *sinusitis*, usually in the antrum; (3) throat, such as tonsilitis or pharyngitis; (4) neck, involving the submaxillary and sublingual glands, the cervical nodes or the areolar tissue. If any of these general or distant complications arise, they should be cared for in conjunction and with the aid of a competent physician. Too much stress cannot be laid on this last statement as some of these cases will end fatally in spite of the most careful and scientific treatment.

The treatment of the local complications in acute surface infections of the mouth is very important. Large sloughs should not be disturbed as they act as a protective covering to the deeper tissues. The same applies to sequestra until they have become thoroughly loosened and can be removed without any great disturbance of the remaining tissues. The antiseptic used should be

very mild and slightly stimulating. One of this type is balsam of Peru, which can be used daily in addition to the regular treatment.

If death of a tooth pulp occurs, the tooth should be opened and treated as though it were to be retained. Abscessed teeth should be handled in the most conservative manner, the use of local heat being recommended rather than the knife. Local heat should be applied to the gums directly over the affected tooth and not to the outside of the face. Raisins or figs heated in milk make an efficient mouth poultice.

Excessive swelling is rather difficult to control, hot mouth washes being the best local remedy. If the swelling extends into the cervical regions, compresses of aluminum subacetate will be found of great value.

As previously stated, operative procedure should be resorted to only in cases of direst necessity, after all other possibilities and means of avoiding them have been exhausted. In cases of saprophytic infection, there should be no operating under any circumstances because of the inability of the blood clot to organize in the presence of an acute saprophytic infection and because of the danger of serious sloughing. Operative procedure being necessitated, it should be as conservative as possible. The wound should be given free drainage and should be treated as is the rest of the mouth. There is one point that should be remembered; and that is, not to use an oxidizing agent in the mouth while there is an open operative wound. Therefore, if the hydrogen peroxid-mercuric chlorid mouth wash is being used, a temporary change to any mild wash, such as the antiseptic alkaline solution (U.S.P.) or Dobell's solution, should be made.

CONCLUSION

The acute surface infections of the mouth are of the utmost seriousness, as shown by the local and general reactions which they produce. Differential diagnosis is made by means of the microscope. Examination of the patient should be thorough with particular reference to the mouth, throat, nose, neck and intestinal tract. The treatment is somewhat the same for acute as for chronic infections, excepting that the acute cases should be handled with extreme gentleness and given complete rest and constant attention. Antiseptics should be used which do not coagulate albumin, kill tissue or interfere with phagocytosis. Complications should be met as they arise, and consultation called for when necessary. One should be reluctant to operate, and, if forced to, should be as conservative as possible. The subject of acute surface infections of the mouth is worthy of more attention than it is receiving. There should be more research by our greatest scientists and there should be more discussion from different points of view, and it is for the latter reason that I give mine, although I am not a periodontist.

40 North Street.

BALANCING THE OCCLUSION IN THE RELIEF OF OCCLUSAL TRAUMA AND OTHER FACTORS IN THE TREATMENT OF PYORRHEA*

By AUSTIN F. JAMES, D.D.S., Chicago, Illinois

MY early experience in dentistry was one of many discouragements because of failure following my most earnest endeavors. I found the same causative conditions continuing in mouths in which I placed reparative work.

The idea of prevention became uppermost in my mind, and for the greater portion of my professional life, that has been my effort; and I have followed more or less all the fads and fancies that have had their run, in their time. This has all finally led to my having convinced myself that I can at least put any set of teeth into as clean condition as it is possible for them to be and, removing as far as possible all other sources of irritation, I have found that Mother Nature is always ready to step in and do her full share.

When we study the pathology of tissue cells, there is always evidence of tearing down and building up. There is never any standing still when living organisms exist, and as long as there is life, the building up predominates. To those who are attempting to prevent or cure disease, the above stated fact should be the greatest encouragement.

Pyorrhea can never be thought of as a disease that could be passed on from one individual to another, or, for that matter, from one tooth to another in the same mouth. It is truly a local infection which may be induced by many causes. There is no doubt that general systemic conditions induced by faulty diet, metabolism or disease will lower the local tissue cell resistance so that infection may be more readily induced. It is universally conceded that where infection is present bacteria are growing in sufficient numbers to attack tissue cells, and it is universally conceded that when we get rid of bacteria, infection disappears.

It is hard for me to understand why there are such things as bacteria. On the other hand, they may have as good a right to exist as we, but we who are fighting infection for the human race must make it our business, as far as possible, to determine where they may not grow, and this must be done just as we fight any other pest, by getting rid of the places that harbor them.

Returning to our particular field of operation, the mouth, there is no doubt in our minds that the normally clean set of teeth and healthy mucous membrane are among the greatest evidences of well-being that can exist. The lack of these conditions is just as good evi-

*Read before the Odontographic Society of Chicago, Feb. 9, 1926.

dence of wreckage and disaster to health and beauty.

Dr. Hartzell has recently said in one of his articles on this subject, that pyorrhea infections are due to streptococci attacking the tissue cells and that if we kept the necks of the teeth as clean as the crowns of the teeth, we would never have pyorrhea. I believe this is true, but to make this possible, we must also eliminate the pockets that harbor the bacteria, or prevent their forming when we get the case in time. And to do this involves many procedures.

If I have any grounds for attempting to discuss this subject, it is because I have made it my life effort to work out in detail and simplify these procedures. Making a diagnosis of any given case involves little that is different from the procedure of the physician in studying the general appearance and condition of his patient; namely, the diet and habits of hygiene and time given to rest and recreation.

In examining the mouth and teeth, it has become my habit to observe first the occlusion, the length of cusps, the general color of the gums and the cleanliness of the tooth surfaces. The depth of pockets and looseness of teeth interest me very little until I have formed some estimate of what has been the probable cause of the destruction of tissue cells, as there can be no pockets unless there has been absorption of the alveolar process. To my mind, lack of function is the greatest etiologic factor, among civilized races. All the supporting structures, as well as the teeth themselves, were intended for vigorous usage, which they do not get with our modern foods and ways of living. The act of incising, tearing and grinding would wear cusps down, and these same actions would give the supporting structures the development and resistance they are intended to have.

Abnormal occlusion, loss of or breaking down of one or more teeth, and the presence of prominent cusps not in normal function have a tendency, in many types of individuals, to bring about what has become known as occlusal trauma, which means simply that leverage force has become established, and the lowered resistance and destruction of tissue cells will occur as a result.

More than twenty years ago, this fact was beginning to be recognized, and I saw Dr. Hutchinson in his office in New York City grind down the cusps in pyorrheic teeth to relieve the wedging stress. This radical treatment so shocked my sense of respect for the natural tooth that I made up my mind that I could never follow the practice. However, my consciousness that there was something happening in these cases that should be relieved or corrected kept me struggling to find out what could be done. There is no doubt that, in malocclusion cases, orthodontia is the proper procedure, and there is no other measure that will correct the occlusion when all the teeth are present.

The Gysi principle of grinding the buccal cusps of lower teeth and the lingual cusps of upper teeth to balance the occlusion in artificial full dentures was the first clue to what has finally evolved itself into what we must do for relief in a natural set of teeth when trauma has developed. It is my habit to fix in my mind's eye what it is that I wish to accomplish in esthetics as well as in relief of the condition present.

We begin by having the patient bring the mandible to incisal occlusion and

see how many of the anterior teeth actually occlude in that position. Then, with a perfectly mounted three-quarter inch stone, I point, or trueup, the incisal line of the upper incisors, and sometimes the cuspids, to as nearly perfect an esthetic appearance as possible. This accomplished, I have the patient bite on carbon paper to mark the incisal edges of the lowers, and, with a smaller stone, grind the lower incisors until all the incisors occlude in a sliding forward and backward movement. This will often bring some of the cusps of the molars or bicuspids into interference to this movement, and their position is then marked by the carbon paper when they are still in this incisal position. These posterior interfering cusps are then ground until there is no jarring or bumping of these cusps in the slightly forward and backward movement. The operation is then carried to the molars and bicuspids in the normal grinding of occlusion, heavy carbon paper being placed on both sides at the same time, normal occlusal stress being exerted, the points of heaviest marking being noted and these cusps ground until there is no movement in the socket of any individual tooth; in other words, until there is no interference and a balanced occlusion is obtained.

No doubt to some this will seem radical, but to those who have never seen this done, I can say that there is no mutilation of the teeth. We find that the interference has come from unworn cusps and from teeth that have been driven or tipped either bucally or lingually until one cusp or another has been raised out of its normal position. As a further argument in the justification of this procedure, the teeth will soon be lost if it is not done.

In mouths in which there is loss of teeth or the teeth are badly broken down from cavities and improper occlusal restorations, the bite becomes closed. The study and diagnosis must be made from the standpoint of the Monson technic of establishing the approximate closure from the normal bite, determining the occlusal planes and center of force to be restored by building up with crowns, inlays and bridges or removable types of bridgework or partial dentures.

In my own practice, the clearing up of infections is the simplest part of the whole procedure. The only question as to whether or not a tooth can be saved is the one of bone destruction. If a tooth has lost all bone support, it should be extracted. If it is loose from inflammation, it can be saved. Infection about the teeth is no different from infection in any other part of the body. If we clean up and get rid of the places that are harboring bacteria, we eliminate the infection. Bacteria can attack tissue cells only when they are growing in masses, and when we reduce the number of bacteria in the mouth to the minimum, we need have no fear of infection.

In this day of the Cameron and Friedman lamps, one can actually see all forms of calcareous deposits on the teeth, both on and below the gum line. There is no excuse for any dentist's not being able to remove them. The only other measure necessary is to put the exposed tooth surfaces into condition so that the patient can keep them clean, and then teach him how to keep them clean.

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Editorial

SOME OF THE REASONS

Frequently, a question is raised by readers, and particularly by authors, with reference to the delay in the publication of papers in our dental journals. Complaints are often made that too long a time elapses between the presentation of a paper before a society and its appearance in the official organ of that society. These complaints are perfectly natural, and the wonder is that they are not more frequent than they are. When a man puts in time and effort on a paper, he naturally wants to see it placed before the profession at the earliest moment, but the difficulty is that the average essayist has not the slightest conception of the routine through which the paper must pass before it is presented to the reader. The proceedings of a society cannot be wafted by wireless from the meeting place to the printed page. Usually, a paper is discussed and the report taken by a stenographer. It requires time to transcribe the shorthand notes and get the report to the editorial office, and frequently the reporting company is

so crowded with other work that there is inevitable delay, a delay which is the fault of no one.

But the chief delay occurs after this, and it is associated not with the editorial office or the reporter but with agencies entirely outside. For instance, here are a few of the things that have happened in connection with the proceedings of a single meeting. It was a meeting of Sections, and the officers were instructed to turn in their material at the time of the meeting. A few of them did this most faithfully, with the usual exception of minor exigencies, which must always be expected; but certain of the Sections were wofully remiss, and in one of them, no report had been received after more than four months had elapsed, though repeated appeals had been made from the editorial office. Then, the condition in which some of the proceedings are turned in causes delay. One important paper was received with only two typewritten pages—evidently the first and the last—and with no illustrations, though these had been referred to by the author. A letter was sent to the essayist with an appeal for the full paper and illustrations, but no attention had been given the matter after the expiration of more than six weeks.

Some papers are sent without the discussions and without illustrations, and all these have to be checked up. One author writes to ask the date on which his paper is to appear, and when informed that it has never been received, and the hope is expressed that he will forward the paper to complete the Section report, he suddenly seems to lose interest in the matter, and fails to answer at all. By following this matter up in the most vigorous way possible, the best that can be done means a delay of at least two months in that report. One manuscript is received in long hand so illegibly written as to be the despair of anyone trying to read it, and yet it must be deciphered with the utmost exactness.

Another paper is set up ready for publication, when word is received by the author to hold it for revision, and more than a year elapses and no revision is yet made, while those taking part in the meeting wonder why the proceedings are not out.

Then there is often delay in the return of author's proof—sometimes as much as six weeks—and when this happens, there is nothing to do but to switch some other material in and let the delayed proof go over to a subsequent issue.

Sometimes casts instead of pictures are sent in for cuts, and these have to be returned to the essayist, because no one except the author can tell from what aspect of the cast a photograph should be made.

All of these and a myriad more such things cause delay, and when it is analyzed, it will be found that, after all, no one is really at fault. It is merely incidental to the exigencies of the situation and to the limitations of human nature. The editor cannot always be familiar with the reasons which cause delay on the part of his contributors, any more than the essayists and readers can be expected to know all the handicaps with which the editor is contending. Each must be charitable and considerate of the other, and while delays if not "dangerous" are always disconcerting, yet they seem to be an inevitable concomitant of publication, and should be accepted with the best grace possible. At least this much may be said—delays are not due to the indifference, the disinterestedness, the bias or the laziness of the editor and his staff.

WHAT BOOKS SHALL THE PROFESSIONAL MAN READ?

The question often arises as to what kind of books the professional man should read. Of course, without argument, he should read books dealing with his own calling. A physician should read medical books; a lawyer should read law books, and a dentist should read dental books. There is no cavil about this; but after that, what shall he read? Tastes differ, to be sure, but there are certain fundamentals which stand good for all time.

Our literature is the most precious possession of the past—the greatest heritage that has been handed down to us by all the ages. There is little new that is being written today; which does not in the least detract from the value of our current literature. We are continually seeing the fundamentals from different angles, and these angles must be interpreted. Literature and art portray to us the emotions and aspirations of the ancients, and no professional man should be wholly ignorant of the things that have been written by the early authors.

The writings of Chaucer seem quaint and uncouth today, but think of the time they were produced. Marcus Aurelius had a philosophy which would do credit to the modern writer. Though he died in the year 180, he said: "To the gods I am indebted for having good grandfathers, good parents, a good sister, good teachers, good associates, good kinsmen and friends." This is a tribute to heredity and environment which has never been surpassed.

Epictetus, who lived just before Marcus Aurelius, said: "But there is only one thing which is fully our own—that is our will or purpose." That one sentence fully comprehended and put in practice would regenerate the world, and yet it is now nearly eighteen centuries since it was uttered by Epictetus, and we are still groping blindly for a philosophy of life, or at least clamoring vainly for the moral stamina to carry it out properly. Evidently, we are not reading the ancient philosophers; or, worse, we are not permitting their philosophy to mold our modern life.

Coming down more nearly to our own time, we find much that is rich in literature. Emerson's philosophy of life appeals to us more strongly because of its intimate adaptation to our modern modes of living. His essay on "Compensations" appeals to the need of every bereft and hungry heart. To the man in despair and grief, it cannot be read without solace.

For style, Macaulay set the pace for writers coming after

him, and it would be good exercise for professional men to read Macaulay somewhat carefully. Not that his particular style, with all of its sonorous rhythm, would best fit into scientific dissertations, but that there is a richness in his vocabulary and a certain ring to his words that carry the reader beyond the ordinary phraseology of the commonplace and the mediocre. And, above everything else, the professional man should avoid reading or producing mediocre literature. Macaulay's essay on Warren Hastings, particularly his description of the trial of Hastings, is a real masterpiece, and is well worth reading more than once.

The names of authors might be multiplied indefinitely and the half would not be told; but there is one writer who has enriched literature in a way that makes his name stand out as the beacon light of all time. William Shakespeare touched the heights and depths of human sentiment, and immortalized himself by portraying the virtues and the faults of men in a way that had never before been approached. Born about the middle of the sixteenth century, when the hearts and minds of mankind had not been tuned to the grandeur of the printed thought, he launched out into the limitless field of human emotion and recorded the ebb and flow, the throb and beat, of man's transcendent moods. No single sentiment, no fleeting motive, no vagrant impulse in humanity's vast conceptions, escaped the ken of Shakespeare's prescient eye; and when the sum total of all he wrote is measured by the march of time, the critic of the future must acclaim that his was the greatest intellect of all time. To know Shakespeare is to know the best there is in the English tongue, and the professional man who makes himself familiar with this myriad-minded man is not wholly without an education.

The taste for good books is a mark of culture, and surely the doctor or dentist should wish to be cultured, at least to this extent. To love books is not only a source of entertainment during an idle hour—it is something more substantial than that. It be-

comes, as the years advance, a solid rock of solace against which the trials and machinations of the sordid side of our lives beat in vain, and no professional man can afford to ignore so certain a resource as this to buffet the ills of life and lend happiness to declining years.

NELVILLE SOULE HOFF, D.D.S.

(1854-1926)

Dr. Nelville Soule Hoff, professor of prosthetic dentistry and former dean of the University of Michigan, College of Dental Surgery, died, December 1, at the home of his nephew in Pomeroy, Ohio, after a lingering illness.

Dr. Hoff was born, July 20, 1854, at Elizabeth, W. Va. His family later moved to Pomeroy, Ohio, where he was graduated from high school at the age of 15. The same year he was apprenticed to Dr. Stafford of Galliopolis, Ohio, in preparation for entering dental school. At the age of 17, he matriculated at the Ohio College of Dental Surgery, where he graduated at the age of 20, entering on the practice of his profession at Cincinnati. Here he continued in practice until 1888, when he was invited to join the faculty of the dental college of the University of Michigan. He held an assistant professorship in practical dentistry until 1891, when he became professor of dental materia medica and dental mechanism. In 1903, he was made professor of prosthetic dentistry; in 1907, acting dean, and in 1911, dean, holding the last named position until 1916, when impaired health led him to resign. He continued as professor of prosthetic dentistry until 1925, when failing health forced him to retire.

Dr. Hoff was a member of the Ann Arbor Dental Society, and the Michigan State Dental Society, in both of which he had at one time held the position of president, the American Dental Association, the Northern Ohio Dental Association, the American Society of Orthodontists, the Institute of Dental Pedagogics and Delta Sigma Delta Fraternity. He held the editorship of the *Dental Register* for nearly twenty-five years, and made many contributions to dental literature over a period of fifty years.

The widow survives, together with a sister and two brothers.

Interment took place at Forest Hill cemetery, Ann Arbor.

DEPARTMENT OF DENTAL HEALTH EDUCATION

WHAT IS HEALTH?*

By JESSE FEIRING WILLIAMS,† M.D., New York City

WHAT is health? In this day, when so many splendid efforts are going forward to promote health, is it not wise to attempt a definition of health? Health is defined in the dictionary as a condition of physical soundness, and for most persons health has this meaning—absence of disease. There is the idea that health exists if the individual is not in a hospital, or is not clearly ill.

But it has been pointed out that there are varying degrees of healthfulness, as indicated in function of the organism, and so, in recent years, this concept has been tagged by the term "positive health," a misleading term, indeed. It is a mistake to use this term "positive health" for educational purposes, because, essentially, there is no such thing as negative health, and, if health exists, it is not less than nor different from "positive health."

The extremely limited ideas of health arise out of fundamental misconceptions of the nature of man, the tendency of all persons to recognize the obvious and fail to see the subtle, and the prevailing doctrine of "health for health's sake." These ideas may be examined briefly.

Health as a state or condition is an expression of the activity of the whole organism and not merely of the physical aspect of life. When man was viewed as composed of mind, body and spirit, separate and distinct entities, it was quite proper to talk of physical health. The practice, therefore, of sending the mind to school to be trained, the body to the shop to be worked and the soul to the church to be saved was in perfect accord with such conception of man.

Modern psychology, biology and sociology teach us otherwise. We say that man is a unity, and hence it is considered absurd to proceed with any plan that fails to recognize this unity.

Recently, in a visit to some public schools in a midwestern state, I saw on the wall a poster which read. "Sound teeth are the foundation of health." Now, of course, you, as experts in this field, know that sound teeth are not the foundation of anything but a good bite. The importance of sound teeth is not to be minimized. I value mine greatly, but what, may I ask, is the characteristic effort in schools and communities that flows out of this concept of health as purely physical? The emphasis is

*Read at the Oral Hygiene Luncheon, First District Dental Society, of New York City, Dec. 8, 1926.

†Professor of Physical Education, Teachers College, Columbia University.

on brushing the teeth. If we were really interested in the health of children's teeth, and had all the pertinent facts, we should see that the health of teeth is not a mere physical problem related to brushing, but a profound sociologic, economic and educational problem related closely to the diet of expectant mothers, diet during infancy, both in form and content, and diet during the critical periods of dentition. Proper care of the teeth is important, but there are other significant aspects of the problem.

Health should be defined, therefore, in broad terms. The definition must be as wide as life, because life is more than digestion, circulation or nerve response. The accumulating evidence from hospitals, social service bureaus and physicians themselves testifies to this unity of life. The causes of ill-health are social and mental as definitely, though not so frequently, as they are physical. Viewing life as a whole, and not as made up of dissected parts, does not mean neglect of the physical. It asks for unity and not multiplicity.

The second theme in my explanation of the limited and constricted view of health is this: Health is considered erroneously to be a quantitative thing. On the contrary, it is not to be measured in quantity at all. Health is not measurable. One does not have so many pound, yards or gallons of health, nor, except for purposes of motivation, can health be scored. If health were merely circulation, or excretion or muscular strength, it could be measured, perhaps, and quantitatively determined, perhaps.

But health is qualitative, essentially. It flows from life, as a function, as a process. It is in this respect much like happiness. For this reason, personal health is not purchasable, regardless of the worth of the famous saying by our eminent state department of health about public health.

Clearly, therefore, health arises out of a way of life, a manner of living, an obedience to scientific laws, a devotion to established principles. It smacks not of laying on of hands, of sudden and dramatic procedures, of heroic technics, but comes from the consistent integration of personal life with the life of the world.

My third theme proposes that health is not an end but a means. Not "health for health's sake," but health as a means to joyous play, satisfying and worthy work and needed service to others. Health for health's sake is as destructive of the finest and best in human life as art for art's sake is destructive of the finest and best in human emotions.

Health is an end only for the person sick in bed. It may then be a very pressing end, to get up, to get well. This tendency to make health an end leads to distortions of the function of life and the importance of the individual.

No person can with safety to his health be interested in his health. Here is the great problem of modern life: how to give intelligent care to and have reasonable regard for one's health and the prevention of disease, and at the same time care not at all for health, but care, and care greatly, for the things that health can do. A great teacher, two thousand years ago, stated the same paradox: "He that would save his life must lose it." Stated today in the light of our modern interest in health, and the complexities, demands and hazards of civilized life, this para-

dox would urge on us health as a means and not as an end.

This idea of health asks that personal and social effort to improve health, to eradicate disease, to enrich the processes of life, be directed constantly toward the purpose of life itself, as that may be understood. Not health, but life itself; this is the goal. Hence, my definition of health is that quality of life that permits the individual to live most and to serve best. For me, the art of fine living consists of the greatest intellectual development and the most worthy social service possible, without loss of power to continue the race adequately, to enjoy life fully, and to be a real source of happiness to others.

REPORT ON INDUSTRIAL DENTISTRY*

By E. L. PETTIBONE, D.D.S., Cleveland, Ohio

DUPLICATES of the questionnaire which is presented herewith were submitted to every firm in the world that was thought to be operating a dental dispensary for employes. Reports were received from eighty-nine industries in the United States and two in Canada. Some interesting reports, and fine letters and literature were received from English industrial dental directors before we learned that Dr. Shipway was to give his report here, today.

We learned of eleven industrial dental dispensaries in Germany conducted by the workers' sick benefit associations, *die Betriebskrankenkasse.* The list of plants is given in Table 1.

*Read before the Section on Mouth Hygiene, Preventive Dentistry and Public Health at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

TABLE 1.—INDUSTRIAL DENTAL DISPENSARIES IN GERMANY CONDUCTED BY WORKERS' SICK BENEFIT ASSOCIATION†

B. K. Hirsch Kupfer-und Messingwerke Berlin	Employers' Sick Benefit Ass'n., Hirsch Copper & Brass Works, Berlin
Der B. K. A. E. G. Berlin-Oberschoneweide	General Electric Works, Berlin, No. 4, Chausseestr 128, 129; Dr. Lindenthal, chief dentist, Drs. Hilde, Marx, Plant, Klein, Associates
B. K. der Rhein. Metallw. & Machinen-Fabrik A. G. Leiter Dr. C. Kukulies Dusseldorf—Worthstr. 13.	Rhein Metal Machine Works, Dr. C. Kukulies, dental Director, Dusseldorf, Worthstr. 13.
B. K. der Schichau-Werft Elbing	Schichau Shipbuilding Works, Elbing
B. K. der Krupp-Werke Leitrer Dr. Fr. Hauptmeyer Essen	Krupp Works, Dr. Fr. Hauptmeyer, dental director, Essen
B. K. d. Optischen Werk-statten Carl Zeiss Jena-Ernst Abbestr. 2	Carl Zeiss Optical Works, Jena, Ernst. Abbestr. 2.

†B.K.=Betriekkrankenkasse.

B. K. der A. E. G. Leiter Dr. Fischer Henningsdorf b/Berlin	General Electric Works, Dr. Fischer, dental director, Henningsdorf b/Berlin
B. K. der Leuna-Werke Leuna-Werke—Krs. Merseburg	Electric Light Works, Leuna-Werke-Krs. Merseburg
B. K. der Staatl. Bernsteinworke Palmucken/Ostpr.	The Prussian Mining and Smelting Stock Co., Amber Works, Palmnicken, East Prussia Dr. Jacquet-Jocobi, dental director
Werft-Betriebs-Krankenkasse Rustringen-Oldenburg	The Dental Clinic of the Workers' Sick Benefit Association, Rustringen—Oldenburg
B. K. der Anilinfarbenwerke Wolfen—Krs. Bitterfeld	The Anilin Dye Works, Wolfen—Krs. Bitterfeld

Dr. Konrad Cohn of Berlin explained that our questionnaires could not apply to German industries, because each employe—each worker—is covered by insurance against sickness and that dental care is provided for in this insurance. In Berlin alone, a district insurance budget takes care of 500,000 from industries and offices. Some of the large industries carry their own sickness insurance to fulfil the legal requirements. There are more than 20,000,000 so insured in Germany. Everyone must be insured wherever employed.

From France, we received a completed questionnaire from Michelin & Company of Clermont-Ferrand (Puy-de-Dome), manufacturers of tires. They are employing four dentists and four laboratory technicians to render service to their 15,000 employes. Their dispensary has been in operation since April, 1924.

From Brazil, we received four replies.

The questionnaire returned by Dr. Heitor Barreto, Rio de Janeiro, Brazil, was very interesting in that it stated that dental service was inaugurated in 1900, by his organization *Cia Luz Stearica, S. A.*, Rio de Janeiro. This makes it the oldest industrial dental dispensary in the world as nearly as we can learn. This company, which manufactures candles, soap and glycerin, has 300 employes who receive free dental service without loss of pay while receiving service. The *Uniao Fabril*, Cotton Mills, Rio Grande, has 2,000 employes. Dr. Jac. Figueira has been their dental director since the establishment of the dispensary, June 1, 1917. Another cotton mill, *Fabrica de Tecidos Esperanca*, Rio de Janeiro, has a dental dispensary which has operated since Jan. 4, 1922. Two dentists are employed.

Comp. Fabrica de Phosphoros "Serra do Mar" manufactures safety matches. Dr. Henrique Lima, Jr., is the dental director.

From the January number of *Oral Topics*, published in London, we learn some interesting facts about the dental clinic at the works of the Electrolytic Zinc Company of Australasia, Ltd., at Risdon, Tasmania. It has been operated since May, 1923, by the cooperation council of the employes, from funds offered by the company and money taken from the insurance funds. The secretary states that, after two years, the clinic has lessened the claims for sick payments and that both the council and the company feel that the

clinic, established and operated primarily to promote good health, has succeeded and, concurrently, has also promoted happiness and efficiency.

From Dr. J. S. Bruske, Amsterdam, we learn that the dental service to workers in Holland is provided by means of sick funds; that the plants do not provide dental clinics, but allow their employes to get treatment at offices of private practitioners. This service is extended to only a few thousand and only about ten dentists are so employed. We commend to your consideration the "Memorandum on a Proposed Organization for Public Dental Service by Sick Funds in Holland" and "Memorandum on Dental Treatment Under the National Health Insurance Acts (Great Britain)."[1]

The reports from the ninety-one concerns in the United States and Canada show that there are 164 dentists employed in these industrial dental dispensaries and that they have assisting them forty-two dental hygienists, 100 nurses, and fifty-seven clerks. The dispensaries are scattered through twenty-one different states and two provinces. The service is available to more than 400,000 employes.

The names of the firms reporting, their location, and the dentists employed are given in Table 2.

1. F. D. I. H. C. Bull., Vol. 2, No. 3.

TABLE 2.—INDUSTRIAL DENTAL DISPENSARIES IN THE UNITED STATES AND CANADA

Firm Name	Location	Dentists
Sullivan Machinery Co.	Claremont, N. H.	F. K. Phillips
Amoskeag Mfg. Company	Manchester, N. H.	F. J. LeClere
John Hancock Life Insurance Co.	Boston, Mass.	F. E. Dimmitt
Gilchrist Company	Boston, Mass.	R. N. Hopkins
Jordan Marsh Company	Boston, Mass.	H. L. Peacock
R. H. White Co.	Boston, Mass.	E. L. Bradway
Walworth Mfg. Co.	Boston, Mass.	Drs. Forbush, Cutler
The Wm. Filene's Sons Co.	Boston, Mass.	Drs. Caldwell, Smith
The Fisk Rubber Co.	Chicopee Falls, Mass.	W. E. Moore
A. G. Spalding & Bros.	Chicopee, Mass.	T. E. Kirby
Dennison Manufacturing Co.	Framingham, Mass.	C. E. Stewart
Babson Statistical Organization	Wellesley Hills, Mass.	Dental hygienist, only
Farr Alpaca Company	Holyoke, Mass.	O. E. Demarest
General Electric Co.	Pittsfield, Mass.	Drs. Ahern, Gem, Hynes
General Electric Co.	Pittsfield, Mass.	Magner, O'Hearn,
General Electric Co.	Pittsfield, Mass.	Shea, Sullivan
National Equipment Co.	Springfield, Mass.	F. M. de St. Quay
Norton Co.	Worcester, Mass.	E. P. Brigham
General Electric Company	West Lynn, Mass.	Drs. F. Ring, Shillington
General Electric Company	West Lynn, Mass.	Homan, Fraiser,
General Electric Company	West Lynn, Mass.	Parcher, Devlin
The Travelers Insurance Co.	Hartford, Conn.	E. S. Arnold
The Yale & Towne Mfg. Co.	Stamford, Conn.	I. D. Beebe
Endicott-Johnson Corp.	Endicott, N. Y.	H. A. Niles
Endicott-Johnson Corp.	Binghampton, N. Y.	Drs. Ivory, Dundon
Endicott-Johnson Corp.	Johnson City, N. Y.	W. L. Rhodes
American Radiator Co.	Buffalo, N. Y.	J. R. Hawn
Washburn-Crosby Co.	Buffalo, N. Y.	E. T. Butler

Firm Name	Location	Dentists
Metropolitan Life Insurance Co.	New York City	Drs. Hyatt, Hunter,
Metropolitan Life Insurance Co.	New York City	Hoffmire, McElroy
Metropolitan Life Insurance Co.	New York City	Browman
Lord & Taylor	New York City	M. Wolkend
R. H. Macey & Co.	New York City	Drs. Bruder, Fendrich
R. H. Macey & Co.	New York City	Schlecter
Union Health Center	New York City, 22 Fourth St.	Max Price and 17
Union Health Center	New York City, 22 Fourth St.	associates
Yellow Taxi Corp.	New York City	H. Strusser
Colgate & Co.	Jersey City, N. J.	W. G. Hunt
Aberfoyle Mfg. Co.	Chester, Pa.	C. A. Bogart
The American Pulley Co.	Philadelphia, Pa.	L. G. Grace
Lit Bros.	Philadelphia, Pa.	L. Eggleton
The J. G. Brill Co.	Philadelphia, Pa.	O. Hays
Phila. Rapid Transit Co.	Philadelphia, Pa.	R. W. Yates
John B. Stetson Company	Philadelphia, Pa.	S. L. Snyder
Edward G. Budd Mfg. Co.	Philadelphia, Pa.	R. E. E. Millington
Stokes & Smith Co.	Philadelphia, Pa.	H. L. Fischer
A. M. Collins Mfg. Co.	Philadelphia, Pa.	T. F. Donohoe
Miller Lock Works of Yale & Towne	Philadelphia, Pa.	A. B. Stevens
Yellow Cab Co.	Philadelphia, Pa.	H. W. Amegst
H. J. Heinz Co.	Pittsburgh, Pa.	W. B. Smith
Kaufman's "The Big Store"	Pittsburgh, Pa.	Drs. G. W. Norris and
Kaufman's "The Big Store"	Pittsburgh, Pa.	H. A. Erny
The Griswold Mfg. Co.	Erie, Pa.	R. V. Sheldon
Berkshire Knitting Mills	Reading, Pa.	Drs. Specker, Herbine,
Berkshire Knitting Mills	Reading, Pa.	Davis, Butler
Joseph Bancroft & Sons Co.	Wilmington, Del.	D. C. Peters
Electric Hose & Rubber Co.	Wilmington, Del.	R. H. Maris
United Railway & Electric Co.	Baltimore, Md.	Drs. Savard, Jackson,
United Railway & Electric Co.	Baltimore, Md.	Page, Demarco
Portsmouth Cotton Oil Refining Corp.	Portsmouth, Va.	J. Coffield
P. Lorillard Co.	Richmond, Va.	Drs. Leach, Tyree
The Va. Alberine Corp.	Schyler, Va.	W. D. Willis
Pocahontas Fuel Co.	Welch, W. Va.	Drs. Epling, Steppe,
Pocahontas Fuel Co.	Welch, W. Va.	Martin, Wagner,
Pocahontas Fuel Co.	Welch, W. Va.	Ruth, Toplitsky
Goodyear Tire and Rubber Co.	Akron, Ohio	H. W. Roehner
Firestone Tire & Rubber Co.	Akron, Ohio	W. T. Easton
National Lamp Works of G. E. Co.	Cleveland, Ohio (Nela Park)	E. E. Belford
National Lamp Works of G. E. Co.	Cleveland, Ohio (Ivanhoe Plant)	E. E. Belford
The Kaynee Co.	Cleveland, Ohio	F. G. Thompson
The Joseph & Feiss Co.	Cleveland, Ohio	G. D. Haggerty
The Halle Bros. Co.	Cleveland, Ohio	W. D. Thomas
The Bailey Co.	Cleveland, Ohio	C. M. Stein
Cincinnati Milling Machine Co.	Cincinnati, Ohio	E. C. Becker
The National Cash Register Co.	Dayton, Ohio	H. M. Brewer
Worthing Pump & Machinery Corp.	Elmwood Place, Ohio	M. C. Schuman
LeBlond Machine Tool Co.	Norwood, Ohio	J. P. Becker
The U. S. Playing Card Co.	Norwood, Ohio	C. A. Schott

Firm Name	Location	Dentists
James B. Clow & Sons	Newcomerstown, Ohio	R. R. Mason
Selby Shoe Co.	Portsmouth, Ohio	O. F. Apel
National Lamp Works of G. E.	Warren, Ohio	C. W. White
Armour & Co.	Chicago, Ill.	G. J. Heyboer
International Harvester Co.	Chicago, Ill.	Drs. Humphrey, Misher,
International Harvester Co.	Chicago, Ill.	Murray, Sanderson,
International Harvester Co.	Chicago, Ill.	Nelson
Hart-Schaffner & Marx Co.	Chicago, Ill.	O. L. Mast
Hart-Schaffner & Marx Co.	Chicago, Ill.	R. Frangenheim
Illinois Lamp Works of Gen. E.	Chicago, Ill.	D. P. Broadbent
Pullman Car & Mfg. Corp.	Pullman, Ill.	E. Goldhorn
Tennessee Coal, Iron & R. R. Co.	Birmingham, Ala.	W. S. Wilson and
Tennessee Coal, Iron & R. R. Co.	Birmingham, Ala.	13 associates
American Cast Iron Pipe Co.	Birmingham, Ala.	N. B. Grayson
E. C. Atkins Co.	Indianapolis, Ind.	B. A. Martin
Kohler Co.	Kohler, Wis.	G. J. Kent
Stix, Baer & Fuller Dry Goods Co.	St. Louis, Mo.	O. J. Bird
B. Nugent & Bro. Dry Goods Co.	St. Louis, Mo.	B. A. Rice
Century Electric Co.	St. Louis, Mo.	E. G. Spuck
St. Louis Lamp Works of Gen. Elec.	St. Louis, Mo.	H. W. Wellman
Union Electric Light & Power Co.	St. Louis, Mo.	J. B. Hellman
Ford Motor Co.	Detroit, Mich.	R. F. Leslie
D. H. Holmes Co.	New Orleans, La.	D. M. Long
R. J. Reynolds Tobacco Company	Winston-Salem, N. C.	R. C. Flowers
Sun-Maid Raisin Growers Ass'n.	Fresno, Calif.	Drs. Dahlgren, Haycraft
The Oakland Mazda Branch of G. E.	Oakland, Calif.	Wm. Watts
Sun-Maid Raisin Growers Ass'n. of California	Selma, Calif.	Drs. White, Shannon Andrews, Wild
Sunland Sales Co-operative Ass'n.	Reedley, Calif.	Drs. Vogt, Ross
	CANADA	
The T. Eaton Co.	Winnipeg	C. H. Vroman
Spanish River Pulp & Paper Mills	Espanola, Ont., Canada	W. E. Boyd

There are others that have not reported after several months' effort. There are also probably some that were missed.

These concerns, besides being scattered throughout the north, east, south and west, represent all kinds of industries. There are dispensaries in thirteen different department stores, eight machinery manufacturing plants, six lamp works, four rubber factories and four shoe factories, the remainder being divided among forty other types of industries engaged in coal and iron mining, soap-stone quarrying, insurance, mail-order business, reporting business, statistics, transportation, rapid transit, electric railways, taxi service, car building and operating, public utilities, stockyards, paper mills, and firms manufacturing the following products:

machinery
valves, tools, pipe, saws
iron and brass fittings
grinding wheels, pulleys
locks, builders' hardware
grinding machines
hoists, industrial trucks
boilers, radiators
farm implements
tractors, automobiles
milling machinery
metal stampings
air compressors
gas, electric and trolley cars
steel specialties

electrical supplies
novelties
soaps, perfumes
tooth paste
paper products
playing cards
shoe laces
electrical apparatus
incandescent lamps
enamel ware
rubber tires, tubes, hose and sundries
cash registers
ready-to-wear clothing
men's clothing
ladies' garments and hosiery
shoes
sporting goods
textiles
felt hats
tags, crepe paper
jewelry boxes
sealing wax
braid
food products: pickles, preserves, cotton seed oil, flour, feed
cigars, cigarettes and tobacco

From this list, it is easy to see that dentistry has not been accepted by industry because of any particular benefit to any one class or type of workers or because of isolation from private dental service. Neither have firms established clinics because their competitors had done so. The employes are of many races and nationalities, and the service is extended to both men and women employes, and to executives as well as employes. There are at least five firms extending the service to the children of the employes. Two concerns extend the service to the children only. In many cases, the service is maintained by the employe's benefit association, and the service is extended to the entire family of the employes.

The more the subject of industrial dentistry is studied, the more we are led to believe that the universal object of its establishment is the desire of the employer to help his employes. This is further established in the replies to the question, "Are the employes paid for the time lost while in dental office?" The almost universal answer is "Yes." The only exception was in the case of piece workers in some industries. The idea of the employers seems to be to make the service as attractive as possible. Almost half of the firms make no charge at all, and in all the rest the charge is nominal. The dentists are nearly all on a salary basis, only nineteen being on a fee basis. There are twenty-eight dentists on full time.

Part time service is by far the better arrangement for the dentist because it gives him a chance to establish himself in an outside practice so that he is protected in case of change of management of the industry. It further protects him against industrial depression, and it is also better for the employe-patient because the dentist has benefited by a point of view obtained in a nonindustrial practice.

The cooperation of the dental with the medical service is almost universal. Two-thirds of the dental dispensaries are under the general supervision of the medical departments.

The answers to the question "What do you consider the most important part of your service?" show best the high ideals of the men engaged in this work.

There were eighty answers to this question. Forty-five mentioned prophylaxis first, then education, preventive dentistry and elimination of local infection. Not more than five mentioned any kind of reparative work. Does this not indicate that the industrial dentist is performing a wonderful survice for the community in teaching the wage earner? It is estimated that the wage earner supports, on the average, four

others persons. What the wage earner learns is respected by the rest of the family.

Judging from the number of firms who are really doing things for their employes, we must sanction what our President, Calvin Coolidge has said:

> I agree that the measure of success is not merchandise, but character. But I do criticize those sentiments, held in all too respectable quarters, that our economic system is fundamentally wrong, that commerce is only selfishness, and that our citizens, holding the hope of all that America means, are living in industrial slavery . . . . the man who builds a factory builds a temple . . . . the man who works there worships there, and to each is due, not scorn and blame, but reverence and praise.

QUESTIONNAIRE

Name of Company or Organization—
Address—
Kind of business—
Number of employes—
Are employes working in shop or office?
Are employes American born, foreign born or mixed?
What nationality predominates?
When was dental service inaugurated, date?
How many dentists were employed in the beginning?
How many dentists are employed now?
Are the dentists part time or full time?
How long has each dentist been with the company?
How many hours per day or week does each dentist work?
Are dental operators paid on salary or fee basis?
How many oral hygienists on staff?
How many nurses on staff?
How many clerks on staff?
Is your dental department under general supervision or medical direction (M.D.)?
What type of service is rendered?
What are the charges to employes?
Are the employes paid for time lost while in dental office?
Are there any restrictions as to the time one must be in service before being entitled to dental treatment?
Is good dental service available in the neighborhood at a fair fee?
What do you consider the most important part of your service?
Do you find industrial workers' mouths in better or worse condition than one sees in private practice?
Are the outside dentists cooperating with you?
Names and addresses of company dentists:
Remarks:—

THE STORY OF THE DENTAL CLINIC OF THE ORTHOPAEDIC HOSPITAL-SCHOOL

By HELEN SINCLAIR, Los Angeles, California

WHEN a dental department was added to the orthopedic clinic functioning under the direction of Dr. Charles LeRoy Lowman, at 1022 South Figueroa Street, Los Angeles, Calif., eight years ago, it had the distinction of occupying the entire "annex," formerly a washroom about 8 by 10 feet in size, containing one high chair, one plain kitchen chair, and, on the arrival of the attending dentist, one half day of each week, a set of dental instruments and a sterilizer transported from the dentist's office. One window about 14 inches square opened into the back yard; and oftentimes the darkening shadows fell before all the work for the little, orthopedically handicapped children who gathered there could be taken care of. When this happened, there was no closing of instrument cases and waiting another

full week, needing more light, they opened the door and let it in. Sometimes they moved into the back yard to finish the work.

Which only serves to illustrate the spirit with which the medical and surgical staff of the Orthopaedic Hospital-School, comprising forty-five men and women, has been welded together by Dr. Lowman. The service for crippled children has been a life ideal, and eight years ago saw the pioneer days of building up his ideal organization, which would bring to the aid of the crippled boy and girl every known medical and surgical science. There were dark days—weeks—months—not knowing how the next step in this building was to be accomplished; but he, too, believed in "opening the door" to service in his organization to the physicians and surgeons who had so much to offer handicapped children—and the light came in. Today, Dr. Lowman is the chief of staff of a medical and surgical body functioning in practically every known avenue of medical and surgical science at the Orthopaedic Hospital-School for Crippled Children, 2400 South Flower Street, Los Angeles—men and women who share his ideals and are actuated by his motives and beliefs, who donate their services to orthopedically deformed children, hundreds of whom have literally risen up from beds of hopeless despair and pain, to call them blessed.

Fig. 1.—The dental clinic at the Orthopaedic Hospital-School. The hygienist is constantly busy with appointments, for dental hygiene is closely allied to certain types of orthopedic disturbances.

To Charles H. Wake, D.D.S., of Los Angeles, belongs the credit of seizing the opportunity opened to the dental profession when, eight years ago, at the first tiny clinic for ortho-

pedically deformed children at 1022 South Figueroa Street, Dr. Lowman invited him to participate in the service his then small staff was rendering the handicapped child. Dr. Wake immediatelv saw the marked correlative advantages to be gained—not alone for the little, crippled patients, but also for the dental profession through its close contact with other branches of medical and surgical science. The opportunity for long period clinical observation

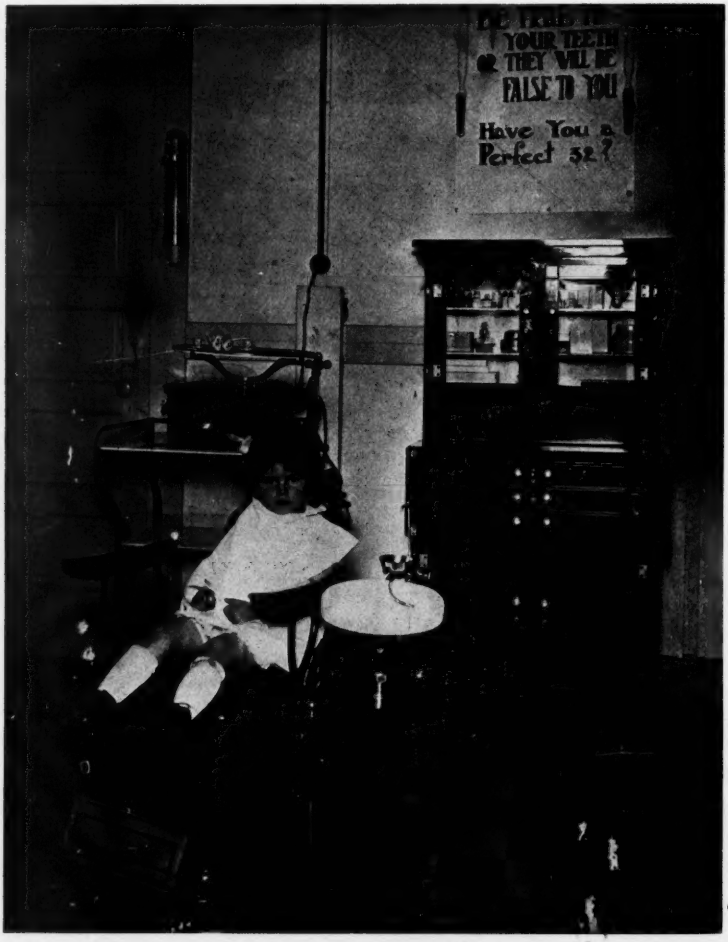

Fig. 2.—The dental clinic. Preventive dental hygiene begins in the nursery, that the temporary teeth may be preserved to play their important part.

was unusual, and, as a unit of a most efficient and growing organization, this dental department of the orthopedic clinic soon acquired characteristics not found in strictly dental clinics; for dental hygiene is closely allied to certain types of orthopedic disturbances; for example, the discovering of local infection of dental origin in a case of bone or joint disease. This dental infection is actually the primary infection, and it is so vitally important in connection with the secondary infection of bone or joint that to cure the one without the other is practically impossible, and the dentist renders a vital service in cleaning up the major infection. In fact, so deeply interwoven have orthopedic conditions and dental hygiene become that many surgeons and physicians on the staff of the Orthopaedic Hospital-School are insistent on the completion of all necessary dental work before they will undertake the surgical procedure outlined for correction of the orthopedic condition. And the correlation is not limited to cases of infection; for unhygienic dental conditions are just so much extra ballast for the crippled child to carry—a child whose every ounce of clean blood and vitality should be working to heal the orthopedic deformity. Appetites may fail for no apparent reason at a critical time when plenty of good food, well digested, is the surgeon's or physician's greatest ally, and the dentist finds the cause in an inflamed or aching tooth. Alleviation of dental pain will restore the lost appetite, and the orthopedic correction can continue.

So through eight years of study and service to the thousands of little crippled patients who have passed under their care, the dental clinic has established a permanent place for itself in the work of the Orthopaedic Hospital-School. The big clinic building was recently remodeled, and a properly equipped dental room with connecting waiting room was included in the plans. Dr. Wake is the chief of the dental staff, ably assisted by C. M. McCauley, and B. L. Reese, orthodontists, Charles Wonder and Leo Fogel, oral surgeons, Winston C. Vance and Lawrence G. Hallock, with Miss Genevieve Rust, oral hygienist, in immediate charge of the daily schedules and public clinic programs at the Hospital-School. The demand for dental service has constantly grown through the years, and has made necessary an intensive educational program of preventive dental prophylaxis with children and parents, a program which has faced peculiar problems on every hand.

For the crippled child is more than abnormally sensitive to pain. Mother and father have shielded him, and it is almost impossible to secure their cooperation in getting him into the dentist's chair, for fear of one more "hurt." Yet a part of the treatment of his condition is dental correction; so the oral hygienist must spend valuable time in securing his confidence, teaching him to value his teeth, showing him how to keep them clean—really training him to educate his parents to the fact that dental hygiene in his case is an essential to cure, instead of something to fear.

Naturally, every effort is made to attract the children to the dental clinic, through the use of pictures, charts, clever little rhymes, games, etc., for above all else, the atmosphere of the dental rooms must not be depressive. "Get them young" is the working slogan of the oral hygienist, who begins

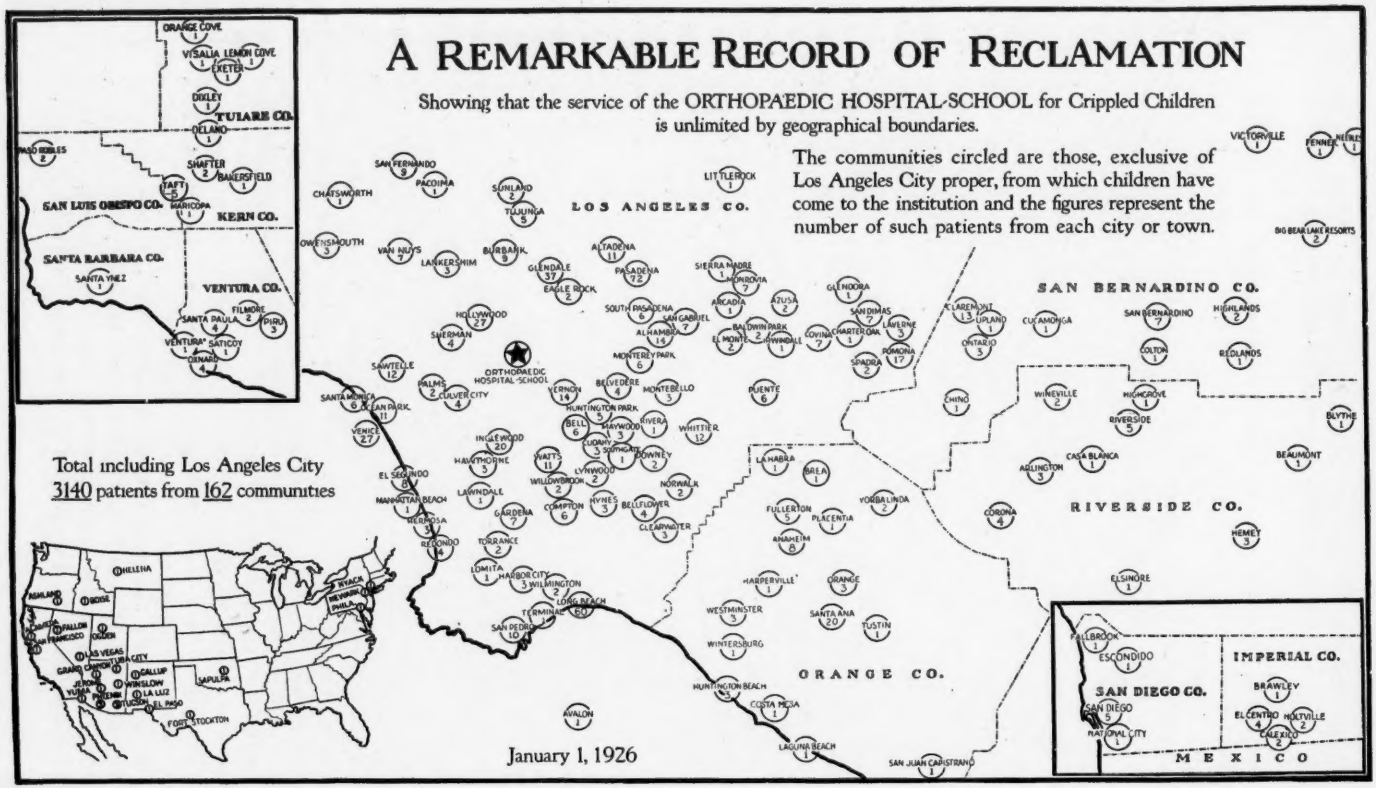
A REMARKABLE RECORD OF RECLAMATION
Showing that the service of the ORTHOPAEDIC HOSPITAL-SCHOOL for Crippled Children is unlimited by geographical boundaries.
The communities circled are those, exclusive of Los Angeles City proper, from which children have come to the institution and the figures represent the number of such patients from each city or town.
Total including Los Angeles City
3140 patients from 162 communities
January 1, 1926
LOS ANGELES CO.
SAN BERNARDINO CO.
RIVERSIDE CO.
ORANGE CO.
SAN DIEGO CO.
IMPERIAL CO.
MEXICO
TULARE CO.
KERN CO.
SAN LUIS OBISPO CO.
SANTA BARBARA CO.
VENTURA CO.
ORTHOPAEDIC HOSPITAL SCHOOL

Fig. 3.—Map showing extent of service of the dental clinic of the Orthopaedic Hospital-School.

in the Hospital-School nursery with her preventive education, in order that the full length of usefulness of the deciduous teeth shall be maintained. The first teeth should remain in place for mastication, to hold the space for the corresponding permanent teeth until Nature is ready for the permanent teeth to erupt, at about the age of 11 or 12 years. Cavities in the first teeth should be attended to promptly; but it is sometimes appalling to note the conditions of these teeth in the little 6 and 7 year old crippled children when they first reach our dental clinic, the results of neglect and ignorance on the part of the parents.

Here the slow process of turning fear into pride begins. There was one little girl, aged 5, who was told as she was taken for her first trip to the dental clinic that, unless she was good the dentist would pull all her teeth out. Small wonder that she arrived crying, cringing, and hysterical, in no condition for the more than a passing examination. Her mouth was in bad condition hygienically, and the toothbrush that she had been supplied with by her parents was the size of the ordinary nailbrush, for her father believed in getting the most for his money. She was given a baby's toothbrush, which intrigued her greatly. Then a game of "find the pearls" was played with her, and gradually she became proud of her clean mouth and wanted every pearl put into shining condition. Her stay at the Hospital-School covered several months, and, after discharge, she reported to the clinic for treatment regularly. Altogether, she was under dental observation for two years. The lessons learned in the Hospital-School nursery have never been forgotten: her toothbrush is used twice daily, and her oral condition is a shining example of the value of early prevention of dental disease.

Problems with the older children assume a little different angle, with the element of fear perhaps more controlled by growing reason. Ignorance of true conditions, neglect which has produced gingivitis, that warning of pyorrhea, and other dental disturbances that lower the resistance of the boy and girl to an oftentimes alarming degree, are the feature difficulties to be overcome. But eight years' background of persistent education and remarkable effort are having its effect, the most noticeable evidence of which is the steady increase of requests from parents and children for dental inspection and treatment.

This increase is, of course, the very goal the dental department of the Orthopaedic Hospital-School clinic has been striving toward; yet, as it is gained, it brings with it the very vital problem as to how to meet all demands with a limited staff. Once again the time has come when more light is needed, and the door of opportunity for service is again opened—wide.

We have, on the one side, literally hundreds of children in whom have been inculcated understanding and desire for regular dental hygiene, during their stay at the Orthopaedic Hospital-School.

Time has brought about their discharge to homes from 5 to 500 miles away, 3,140 of them, to be exact, from 162 different communities of Southern California, and from thirteen states, stretching as far away as New York and Pennsylvania. The accompanying map of service (Fig. 3) shows the scope of influence which the Ortho-

paedic Hospital-School has spread to countless homes in these towns and communities; and the greater percentage of our patients are from homes where regular dental treatments are a financial impossibility. The great question before the dental clinic today is this: How are we going to prevent the dental work which has been accomplished with these children from lapsing? How are the problems of distance, travel and time necessary to come to Los Angeles for regular dental checking up (in many cases absolutely vital to permanent physical rehabilitation) to be met?

There is a way, a dream or ideal of the dental clinic. It will require time, effort, service and affiliated cooperation on the part of the dental profession as it is represented in the many towns, cities and states where the influence of the dental clinic of the Orthopaedic Hospital-School has spread. It will mean that, in time, these towns, cities and states wherein patients from this Hospital-School reside will be zoned dentally, so to speak, with a member of the dental profession in each zone affiliated with the medical and surgical staff of the Orthopaedic Hospital-School, and in charge of the dental inspection and work of the orthopedic patients returned to their homes for the last recuperative steps toward health which time alone can give. Certain steps to bring about this zone solution of our problem have already been taken locally and are meeting with cooperation and approval of the members of the dental profession so far approached; for it is fast being realized that there is a tremendous value to the profession at large in the correlation of dentistry with other branches of medical and surgical science. One by one, the contacts with dentists whose spirit of service understands our need is being made; but the field is so large that time alone can guide in the organization of an affiliated dental membership on our staff which will completely solve the problem. Here indeed is opportunity. The door is again opened wide to those public spirited dentists who, reading this message, may be desirous of widening their contacts and, at the same time, offering a service of incalculable value to orthopedically handicapped boys and girls who are struggling to a healthier, stronger young manhood and womanhood. The plan of affiliation is not intricate, and a letter to Dr. Charles H. Wake, chief of Dental Clinic, Orthopaedic Hospital-School, 2400 South Flower St., Los Angeles, Calif., will bring immediate response and full information. If you who read this article are interested—write!

The National Child Welfare Association, Inc., 70 Fifth Ave., New York City, has prepared a new set of posters on mouth hygiene. The following subjects are covered:

1. Baby's Teeth Are Built
2. Breast Feeding
3. Armor the Teeth
4. Enemies of a Beautiful Mouth
5. Protect the Baby Teeth
6. First Permanent Molars
7. Don't Starve Your Teeth
8. Nature's Toothbrushes
9. Work Your Teeth More
10. Clean Teeth and Gums
11. Keep Your Toothbrush Clean
12. Our Friend the Dentist

The posters are 17 by 28 inches, hand-lithographed and hand-colored. They will be found helpful in schools, clinics and offices and in connection with health days and weeks.

Complete series of 12 posters to one address, postpaid $6.00
Single posters, postpaid ..... .60
Colored lantern slides, postpaid, each ..... .80

Bulletin 95, with illustrations of the posters, may be obtained from the National Child Welfare Association, Inc.

DENTAL HYGIENE IN THE HEALTH PROGRAM OF THE PUBLIC SCHOOLS*

By CHARLES H. HENSHAW, D.D.S., Des Moines, Iowa

IN 1916, the dentists of Des Moines conducted a dental survey of all school children, at the request of the supervisor of the health department of the schools. Conditions were bad. Of 5,171 children examined in the first seven grades, only 8.5 per cent had received dental treatment; 49 per cent used a toothbrush, and 14 per cent were reported as not needing dental service. There were 3.74 cavities per child in deciduous teeth, and 2.91 cavities per child in permanent teeth.

The year following this survey, the board of education secured the services of a dentist for nine hours per week, at a central clinic.

In 1918, a dental hygienist was employed to assist the dentist, and also clean the teeth of those who came to the clinic. The dentist's schedule was then raised to twelve hours per week.

In 1920, the hygienist was given a portable equipment, and was sent from school to school, cleaning the teeth of all pupils who did not present an objection in writing. An assistant was secured for the clinic.

In March, 1923, a dentist was employed for full time, and, in 1924, a dentist, on part time, as supervisor, and another hygienist were added to the staff.

In the school year just passed, 1925-1926, the bureau had a dentist on part time as supervisor, a full-time dentist and assistant at a central clinic, two dental hygienists with portable equipment in the grade school buildings, cleaning teeth, and giving instructions for oral health at the chair and in classroom talks. There are between 17,000 and 18,000 children in our fifty-one grade school buildings. During the last two school years, the two hygienists have completed the cleanings and examinations in all these buildings, and have started the second round.

During 1925-1926, the hygienists have examined 11,852 in the seven lower grades, 54.9 per cent of whom had previously received the attention of a dentist. In 1916, only 8.5 per cent had been to a dentist; and 91 per cent are now using a toothbrush, against 49 per cent in 1916. These are figures that are gratifying. But in the 1925 survey made of kindergartens and first and fifth grades, some of the comparisons are not so good. The 6,406 examined averaged 2.6 cavities per child in deciduous teeth; while, in 1916, in the same grades, 1,209 children averaged 2.3 cavities per child in the deciduous teeth. There is a gain made in the permanent teeth. In 1925, the ratio was 0.5 cavities per child, and in 1916, 0.9. The conclusion most apparent in these figures is that in spite of the greater number being sent to the den-

*Read before the Section on Mouth Hygiene, Preventive Dentistry and Public Health at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

tists, there is not a great decrease in the number of cavities. Therefore, the dentists should awaken to this need.

A physician recently said that the day of the old school doctor who examined a patient, said nothing, and wrote a prescription, is rapidly passing. The newspapers, magazines and other educational forces are making it necessary for him to give the patient his opinion of the case. Speed the day when a dentist can no longer say to a parent, "Those are only temporary teeth, and will come out soon. It does not pay to fill them."

The city of Des Moines claims a population of 140,000. There are fifty-one grade schools, housing kindergarten, first, second, third, fourth, fifth and sixth grades, about 18,000 strong. The dental bureau does not care for the junior or senior high schools, except in the suggestion of oral hygiene taught in these higher grades, and emergency work at the dispensary. With this small staff, little could be accomplished, without the cooperation of other departments.

The bureau of dental hygiene is a part of the health department which has a physician on part time as director.

Other bureaus of the health department consist of: the bureau of medical examiners, with five examining physicians on part time who go from building to building making general examinations; the bureau of nursing, with a supervisor and twenty-two nurses who visit most buildings two or three times weekly, except in the junior and senior high schools, where there are full-time nurses who teach classes in hygiene; and the bureau of physical education, with a supervisor and one or more physical education teachers in most buildings. There are a few small outlying buildings that do not have a teacher of physical education.

The examining physicians, during the general examination, note dental defects, and a notice of such defects is sent to the parents. This notice merely states that there is a defect, and does not suggest a treatment or give the number of cavities found.

The nurses keep a list of the children with dental defects, which is made out by the hygienist when the teeth are cleaned; send notices to parents, and follow up the cases, sending the child to the school clinic if he is financially unable to have the work done. Those who can afford dental care are referred to their own dentists.

The physical education teachers give instructions in hygiene of which dental hygiene is a part. The dental hygiene is outlined by the supervisor of the dental bureau.

The homeroom teachers make a morning inspection. Hair, face, hands, finger nails, clothing, teeth, etc., are inspected for proper care and cleanliness.

The dental clinic cares for the cases sent by the nurses. In the school year just past, there were 1,246 children cared for at the dispensary. The services rendered were: 1,643 extractions, of which 120 were of first permanent molars; 2,692 fillings, consisting of 1,767 amalgam, of which 941 were in first permanent molars; 854 oxyphosphate of copper cement fillings, of which 319 were in first permanent molars; twenty-six sylicate cements, twenty-three zinc cement fillings, eight-

een guttapercha fillings, four root canal fillings, 782 protected pulps, 446 silver nitrate treatments, and 157 other treatments, including treatment for inflamed gums and Vincent's infection. From April 1 to July 1, 102 cases were completed. A record of this was not kept previous to April 1.

It is impossible to give a financial statement of the last school year at the time this paper is being written, for the bureau closes its work July 1, and the figures are not yet available. In the school year 1924-1925, $8,250.00 was paid for salaries, and $1,125 for supplies and equipment, making a total of $9,375.00. In this same year, the two hygienists examined 9,322 mouths and gave 9,053 prophylactic treatments. A cleaning then cost about 49 cents, but if those examined and not given prophylactic care are added, it is reduced to 48 cents for each child cared for by the hygienists. At the clinic, the cost was $2.56 for each child, and 56 cents for each operation. This does not include the salary of the supervisor, which was charged to the educational program.

As it is not wise at this time to add to the budget of the bureau of dental hygiene, it is necessary to attempt to better dental conditions without any additions to the staff. To this end, a change has been made in the dental program for next year. To some extent, this program follows plans suggested by the oral hygiene committee of the Iowa State Dental Society. We are also indebted for many suggestions from Miss Mary Ella Chayer, our supervisor of nurses, who worked with William R. Davis, while he was in charge of the dental program in Saginaw, Mich.

The plan is to put on an educational program, stressing the need for care of dental defects. This is to be accomplished by: (1) examination of the first seven grades, and notices sent to parents when defects are found; (2) cleanings, followup, and instruction by dental hygienists; (3) followup by the nurses and physical education teachers. Time does not permit going into this plan in detail. Several charts for display in rooms and buildings, and other educational features, are to be used.

Now, what has been accomplished in these ten years? In 1916, 8.5 per cent of children examined had previously received dental treatment; 49 per cent were using a toothbrush, and in the kindergarten, and first and fifth grades, there were 2.3 cavities per child in the deciduous teeth, and 0.9 cavities per child in the permanent teeth. In 1926, 54.9 per cent had received dental treatment; 91 per cent were using a toothbrush, and in the kindergarten, and first and fifth grades, in 1925, there were 2.6 cavities per child in deciduous teeth, and 0.5 cavities in permanent teeth. Practically every child in the Des Moines public schools has had his teeth cleaned, and had instructions in the care of his mouth by a hygienist at least once, and perhaps several times. A fair percentage of those who were financially unable to pay for dental services have been cared for at the school clinic. All who had dental defects have been urged to see a dentist and many have followed this advice. With adoption of a new plan next year, great reduction in the number of cavities is expected.

One important factor for the success of any program is correlation and cooperation of all departments interested in hygiene and health.

1112 Bankers Trust Bldg.

THE PUBLIC DENTAL STANDARD IN NORWAY*

By IVAR KROHN, D.D.S., Oslo, Norway

EDUCATION AND LEGISLATION

IN this paper, I propose, first of all, to give an account of the work done by the Norwegian Dental Association to improve oral conditions in Norway, and the course the association will pursue in order to give the public greater facilities in getting dental treatment and also to educate the public to realize the importance of healthy teeth.

This paper falls therefore naturally into two principal parts: (1) steps taken and to be taken to put the instruction of dentists on a broader plane; an extended instruction in propedeutic, especially odontologic and medical, subjects; and (2) the association's community service.

From 1884, when the Norwegian Dental Association was founded, the demand for greater stringency in the rules governing examinations was voiced with increasing strength. As early as 1887 the Association tried to obtain a public dental institute, which should undertake the whole course of instruction. The examination artium was to be required for admission. (This examination corresponds to high school plus two or three years of college.) But the authorities were not sufficiently sympathetic, and twenty-two years passed before the demands were complied with.

*Read before the Section on Dental Legislation at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

The dental association itself had, in the meantime, taken steps to make the requirements more stringent, and, September 4, 1905, founded the Technical Institute of the Norwegian Dental Association. The result of this was that, in 1909, the state took over the whole course of instruction and founded the National Institute of Dentistry, in accordance with suggestions and plans drawn up by the association.

Dec. 8, 1920, a report was rendered to the Storting (our parliament) by a committee consisting of the four head teachers, and of three members appointed by the association, suggesting a revision of dental instruction in Norway. This report recommended that the period of study for dentists be increased from three to four years, and that new propedeutic subjects be included in the curriculum. It suggested also a broader instruction in medical subjects. Later, the government appointed a committee consisting of a representative from the board of the Institute of Dentistry, a member of the medical faculty of the university and a representative from the dental school-clinics. Dec. 18, 1922, this committee rendered a report which forms the basis of the present instruction in the theoretical subjects.

I shall call your attention to some of the suggestions made in this report:

Chemistry.—Chemistry as a whole is studied, but the chief emphasis is laid

on metals, especially those pertaining to dentistry.

Applied Physics and the Use of Apparatus.—The course of instruction has not yet reached its final form. In this course, the study of physics is repeated, with special emphasis on the use of apparatus. We plan to widen the scope of this instruction.

Bacteriology. — A well-balanced course in bacteriology preceeds the regular course in pathologic anatomy. Both courses are given at the university. The students have the opportunity to prepare cultures and slides.

Dental Anatomy.—With us dental anatomy comprises the study of an excellent collection of teeth, including jaws from the viking period. A museum for the study of comparative dental anatomy is now being established and already contains many specimens. In addition to representative collections of craniums of vertebrates, we are arranging a group of special forms characteristic of the Norwegian fauna, as, for example, ocean mammalia and the wild reindeer. Thus, we expect before long to have a collection unique in its kind.

The leading principle in the teaching of dental anatomy is to bring the student into immediate contact with the objects of study, chiefly by means of individual instruction. In our opinion, a subject as difficult as dental morphology, for instance, is best taught in this way.

Anatomy and physiology are studied side by side, and the study of descriptive anatomy is followed by the course in histology. The structure and functions of the various organs are so intimately connected that time is saved by such a method of study.

The subject of physiology of nutrition is of such importance to the dental profession that a special lecturer is needed. This will be provided for in the fall, when the Institute of Dentistry will have its new building.

It is to be regretted that a four-year course is not given, as suggested by the association, but we can well understand that the authorities in the present financial situation, are unwilling to increase the period of study.

COMMUNITY SERVICE

As in many other countries, the number of dentists in Norway at the close of the last century was small. At this same time, the public began to realize the need of more extended dental service; consequently, the demand for dentists became very pressing. This was felt especially during the period of prosperity (1914-1920). For a population of 2,700,000 there are today about 750 dentists, or one dentist to every 3,660 inhabitants. Among the various countries, Norway is presumably second as regards the number of dentists in proportion to the population. The United States, with one dentist per 1,740 inhabitants, stands wholly by itself.

Under the financial situation existing during the later years, in spite of the seemingly good supply of dentists in Norway, it must be admitted that dental service gradually has become too expensive for the masses of the population. When the Health Insurance Act of 1909 was under discussion, and again when it was revised and modified in 1915, the Norwegian Storting considered including dental treatment in the insurance act. The dental associa-

tion had, however, made a report on the question, dealing exhaustively with the matter and had shown that, economically, such an arrangement would not be within reach of state and municipalities. The Health Insurance Act, which affects wage earners of up to 6,000 kroner (about $1,300) a year, does not include dental treatment except as it gives the insured reimbursement for extraction of teeth and a few operative incisions. As recommended by the association, the state now pays one-fourth of the salaries of the school dentists, the municipalities the remaining three-fourths.

The Act of Dec. 14, 1917, concerning the elementary schools in the towns provides for free dental treatment for all children. This provision should be effective for the whole country in the course of ten years. Owing to the financial situation, this period has now been extended by an additional ten years. The reform has been carried out in practically all the towns, and in a number of the country districts, which receive the same state grant.

The Norwegian Dental Association has worked out a scale of salaries for the school dentists which has been adopted by the municipalities. Furthermore, the association supplied the municipalities with directions for the establishment and work of school dental clinics, and also for the treatment of children's teeth.

The purpose of the latter is to standardize an inexpensive dental treatment in the schools. The directions, which are addressed to the school dentist, contain clear and definite rules about treatment, filling material, etc. The treatment must aim at the conservation of the pulps of the permanent teeth and the maintenance of the mesiodistal measure. Consequently, the deciduous teeth should not be extracted until the first permanent molar has come completely into view, and a first permanent molar whose root needs treatment should not be extracted until the bicuspids have emerged.

ROOT TREATMENT

Root treatment of molars cannot be undertaken by school dental clinics. As a provisional treatment of the first permanent molars and the temporary teeth, a paste of eugenol and zinc oxid on the bare pulp is recommended. A few crystals of silver nitrate should be added to the paste where there is carious dentin and not bare pulp.

In cases of pulpitis, thymol arsenic should be applied for twenty-four hours. The pulp of the crown should be carefully removed, and the pulp chamber filled with iodoform paste and the rest of the cavity with cement.

For disinfection of infectious root canals, Howe's silver nitrate plus eugenol should be used. It is not necessary to clean out the canals. The pulp chamber should be filled with iodoform paste and the cavity with cement or copper alloy.

In cases of small buccal cavities, painting with silver nitrate is recommended.

FILLING MATERIALS

In the school, treatment of the permanent teeth should be based on alloy—cement and guttapercha fillings. In the front teeth, copper cement, other phosphatic cements and durable guttapercha are recommended. Silicia cement must not be used for children under 13 years of age.

Dietetic rules are also given.

EXAMINATION AND TREATMENT

At the school dental clinics, there shall be a compulsory examination and treatment of the teeth of all children at least once, but preferably twice, a year.

Continued Dental Treatment at School.—The Supervisory Board of the Norwegian Dental Association, at a meeting held, July 6, 1926, passed a resolution to the following effect:

The Norwegian Dental Association recommends that the local Association shall, with municipal support, organize a plan for continued dental treatment beyond the scope of the elementary schools for children up to 17 years of age in cases in which dental treatment at school has been systematically carried on.

The object of this treatment is to maintain the results already obtained in the preceding school treatment.

1. The treatment should, preferably, take place at the school dental clinic and be performed by the school dentist.
2. The municipality shall provide the necessary premises and instruments.
3. The salaries of dentists shall be covered by fees from patients. Premises and instruments being free, fees can be reduced to a reasonable extent.
4. The local association shall have charge of this service, and shall exercise the requisite control in connection therewith through its board or, preferably, through the inspection committee of the school clinic. This committee of inspection includes a member of the local association's board.
5. For these treatments, the ordinary filling materials (see Directions II for school dental care) should be used.
6. Any arrangement shall be subject to the approval of the Norwegian Dental Association.

CARE OF THE TEETH IN THE ARMY

Military dental care has been encouraged and advanced by the Norwegian Dental Association, with the result that we now have a consulting dentist attached to the medical staff, in charge of the distribution of dentists in the various training camps. Furthermore, candidates desiring to be admitted into the schools for officers and noncommissioned officers, but found to have bad teeth, are rejected forthwith. All noncommissioned candidates have free dental treatment during their time of training. Dental students subject to military service take the required training in the medical corps. They go through a special course together with the medical students and receive the rank of military officer after passing the examinations as dentists. During their military service, dentists are under obligation to give propaganda lectures to the soldiers.

The Association for Prevention of Dental Diseases works hand in hand with the Norwegian Dental Association in educating the public, and in assisting at the appointment of dentists at various hospitals and public institutions. Furthermore, it has organized systematic propaganda among the people through the schools, by means of the school nurses and the nurses attached to the board of health. Cooperation has also been established with the Norwegian National Association for the Prevention of Tuberculosis, the Sanitary Association of Norwegian Women and the Red Cross.

In the belief that as a result of popular enlightenment, the people will ultimately demand that dental diseases be placed on the same footing as other diseases, the Association frequently distributes popular leaflets and lends films for the purpose of propaganda.

From what has been stated above, it will be seen that, in its community

work, the Norwegian Dental Association pursues and for the past ten to fifteen years has pursued a definite course. In conformity with the view advocated by the International Dental Federation, it bases its activities on the system of school dental clinics. The children get instruction and systematic treatment, without charge, from the age of 6-7 to the age of 13-14, the expenses being borne by state and municipality. The association will, as I have stated in the preceding, now take steps to extend this treatment to the seventeenth year.

But, whether dental service at low cost, with or without public support, should, in addition to the above mentioned system of school dental clinics, be organized for the mass of the people is a debated question. Some would have the cost of dental help included, wholly or partly, in the taxes, in some form or other, or included among the grants made by the public sick benefit funds to their members. Some enterprising, unorganized dentists have, on their own responsibility and at their own expense, set up so-called popular dental clinics and carry on this service as an ordinary practice for the sake of gain. The Norwegian Dental Association does not permit its members to engage in such an enterprise.

The association holds the view that the authorities—either state or municipality, should not give any considerable support toward systematic dental treatment for adults.

If dental treatment at school is carried out to the fullest extent and, if possible, is extended so as to include care of the temporary teeth and also the teeth of children up to the age of 16-18 years, it is a question whether the public is not best served by competition among dentists, working freely for their own living, and sufficient in number to meet all the dental requirements of the nation. As far as I can understand, this view of the matter is in harmony with what, with certain modifications, has been set up by the International Dental Federation, through its hygiene committee, as the guiding principle.

Medical and Dental News

GEORGIA

New Medical Arts Building: The new Medical Arts Building, which opened in Atlanta the first day of last December, is occupied largely by members of the Fulton County Medical Society and the Fifth District Dental Society. The first floor of this twelve-story building is occupied by a pharmacy, surgical and dental supply houses, an optical house and a bank. Development of club features within the building is planned for the near future, together with a garage connected with the building.

IOWA

University District Society Meets: The University District Dental Society met, December 9, at Cedar Rapids. E. T. Tinker, Minneapolis, gave a talk on the comparative advantages of partial dentures and fixed bridges, and C. P. Jeans, head of the department of pediatrics at the state university, gave a talk on "Rickets." The following officers were elected for the ensuing year: president, A. W. Bryan, Iowa City; vice president, E. J. Thoen, Iowa City; secretary, L. W. Butterfield, Cedar Rapids; treasurer, J. J. Booth, Marion.

Northwestern District Society Meets: The Northwestern District Dental Society met, December 6-7, in Sioux City. R. O. Schlosser, of Chicago, presented a lecture demonstration of the complete procedure of constructing a full denture case. E. W. Howard, Des Moines, conducted a lecture clinic, indicating the usage of porcelain tipped pontics, together with the technic of baking the porcelain. E. M. Hall, Kansas City, lectured on the several phases of the pulpless tooth, the differential diagnosis and root-canal technic. At the business meeting, the following officers were elected: president, C. E. Westwood; vice president, C. E. Chitty; secretary, Mort Henkin; treasurer, R. C. Matteson.

MINNESOTA

Students Invited to Attend District Meeting: For the first time in the history of the St. Paul District Dental Society, the junior and senior classes of the University of Minnesota College of Dentistry were invited to attend a meeting, December 14. Arthur D. Black, of Chicago, was the speaker of the occasion, his subject being "The Pathology of the Pyorrhea Pocket and the Advantages of Eliminating the Pocket in Treatment."

MISSOURI

Deaner Institute Closes: The Deaner Dental Institute, founded five years ago, by J. J. Deaner, of Okmulgee, Okla., and W. H. Jordan, Kansas City, voluntarily closed its doors recently, and the professional heads and associates who have conducted the institute and dental clinic will reenter private practice. It was the plan of the founders to establish an institution where every branch of dentistry would be available under one roof, where research could be fostered and postgraduate instruction could be obtained. The carrying out of this plan proved too costly and work had to be suspended. The children's clinic will probably be continued until the close of the current school year.

NEW YORK

Alumni Clinics: Six hundred alumni of the New York University College of Dentistry attended a series of scientific sessions, arranged by the factulty, dealing with modern developments in dental science, December 17. More than 400 alumni who wished to attend the lectures and clinics were unable to do so because of lack of space. Preventive orthodontia was discussed by Frederick L.

Stanton; oral surgery for the general practitioner, by Leo Winter; the radiogram in periodontia, by J. O. McCall; full denture prosthesis, by Victor H. Sears; partial denture prosthesis, by Clyde H. Schuyler, and the technic of casting inlays, by Louis J. Weinstein. Visits to the laboratories and clinics, where approximately 300 operations are performed daily and where 30,500 patients were treated last year, followed. At the general session, E. D. Friedman lectured on "Pain," and the dean spoke. Reorganization of the alumni association was effected.

Ohio

Cleveland Dental Society Meets: The Cleveland Dental Society met, January 3, at the Hotel Winton. The late afternoon was given over to a council meeting and two clinics: "A New Method of Securing Occlusion in Artificial Dentures," by W. B. Gerow, and "Correct Technic for Ascher's Artificial Enamel," by E. J. Ostendorf. The after dinner speaker was Marcus L. Ward, of Ann Arbor, who spoke on "The Comparative Usefulness of Amalgam and Other Materials for Filling Teeth."

State Dental Society Meets: The Ohio State Dental Society held its sixty-first annual meeting at Columbus, December 7-9, with a registration of 1,342. The newly elected officers are: president, J. V. Gentilly, Cleveland; president elect, J. W. Hartshorn, Toledo; vice president, E. S. Braithwaite, Willard; secretary, E. C. Mills, Columbus (reelected); treasurer, A. O. Ross, Columbus (reelected). Plans were matured to publish a quarterly bulletin, and a more extensive oral hygiene campaign, with a director of oral hygiene under the state director of health, appointed by the state, was endorsed. The next meeting will be held in Cleveland, December 2-4, with F. M. Casto as chairman of the arrangements committee.

Pennsylvania

Odontological Society Meets: The annual meeting of the Odontological Society of Western Pennsylvania was held at Pittsburgh, November 29-December 1. Among the essayists were W. E. Harper, of Chicago, who spoke on "The Essentials and the Art of Making Adaptable, Strong and Stable Amalgam;" J. J. Posner, New York City, on "Local Anesthesia Simplified;" Edward Kennedy, New York City, on "Partial Dentures;" F. B. Rhobotham, of Chicago, on "Dentistry for Children;" D. D. Campbell, Kansas City, on "Impression Technic;" and Newton G. Thomas, on "Economics of a Dental Officer." The following officers were elected for the ensuing year: president, C. W. Hagan, Wilkinsburg; vice president, D. Willard Flint, Pittsburgh; secretary, Leslie Waddill, Pittsburgh; assistant secretary, S. S. Haudenshield, Carnegie; treasurer, C. R. Garmen, Pittsburgh.

Dr. Ramsey to Practice in London: K. Paul Ramsey, a recent graduate of the University of Pennsylvania, formerly a resident of Reading, and recently in practice in Philadelphia, sailed for London, December 27, to enter practice in association with T. Victor Smith.

South Carolina

Dental Advertising: DENTISTRY: Le Citoyen TESSIER informs the Public that he proposes to continue his former occupation of Dentistry, in Charleston. His experience in Paris and several parts of the French West Indian Colonies persuades him that he shall meet success in this place. He Cleanses the Teeth, LEADS them, and Sets Artificial ones. He composes a Vinegar which dissolves the Tartar which covers the Teeth, and Cures generally all mouth distempers and scurvy. No. 34 Old Church Street, at the Oldman House, or the Sign of the Maccarony, near the French Play-House, pres de la comedies Francaise.—*South Carolina State Gazette*, Nov. 14, 1794.

[It is generally believed that "Le Citoyen Tessier" was one of the unfortunate French refugees who found shelter and business in Charleston, S. C., at the time of the negro risings in San Domingo and the murder of all white and mulatto persons there by the out-and-out black Africans; he would, with the rest of his unlucky compatriots, have been designated in the city directories of his day, had there been one, as "Ref. St. Dom." or Refugee San Dominique.]

M. BISSEL, SURGEON-DENTIST: Respectfully tenders his Services to the Citizens of Charleston. Mr. Bissell makes and inserts the SILICIOUS METALLIC or INCORRUPTIBLE TEETH, as made and inserted by C. Starr Brewster, and performs all other operations of DENTAL SURGERY.—*Charleston City Gazette and Commercial Daily Advertiser*, Aug. 23, 1832.

Foreign

J. Howard Mummery Memorial: Announcement is made in the *British Dental Journal* of November 15 of the establishment by the Representative Board of a memorial to the late J. Howard Mummery. A list of subscribers to the fund will be published in the near future. The memorial will probably take the form of a prize in dental research.

General

Golf Tournament: Announcement has been made of the winners of the 1926 Tournament of the American Dental Golf Association, held in Philadelphia last August. Of the ninety-two contestants, the winners were: G. T. Gregg, Pittsburgh, Pa., champion; Robert N. LeCron, London, England, runner up; J. J. Hillsley, New York City, handicap winner; Edward F. LaFitte, Philadelphia, Pa., runner up; Class A: low gross, A. M. Yessler, Woodstock, Ill., runner up E. W. Browning, Salt Lake City, Utah; low net, Reinhard Nell, Philadelphia, Pa., runner up, W. W. Powell, Philadelphia, Pa. Class B: low gross, A. J. Hefferman, Wilkes Barre, Pa., runner up, Harvey Schwalm, London, England; low net, A. E. Webster, Toronto, Canada, runner up, A. L. Orr, Philadelphia, Pa. Class C: low gross, H. E. Beiser, New York City, runner up, Frank J. Erbe; low net, Harold R. Mead, Schenectady, N. Y., runner up, A. L. Mulford, Philadelphia, Pa. E. E. LaFitte, Philadelphia, turned in the best gross score for morning play; E. W. Browning, Salt Lake City, the best gross score for afternoon play. O. W. White was elected vice president; Thomas P. Hinman, Atlanta, Ga., secretary-treasurer (reelected). Frank M. Casto, Cleveland, Ohio, has concluded the second of his three-year term as president. The 1927 tournament will be played in Detroit.

Vitaglass: The New Health Society received about fifty representatives of the press and others interested in health questions, at the Zoological Gardens (London), to meet Mr. F. E. Lamplough, the inventor of "vitaglass," and to inspect the installations in the gardens. Dr. S. H. Belfrage explained that the New Health Society, whose object was education in all matters affecting health, attached a high value to Mr. Lamplough's invention of "vitaglass" and to the successful experiments in its use made at the zoo. Ultraviolet rays had a stimulating effect on general growth, on the power of resistance to disease, and on the richness of the blood. They were closely associated in their qualities with the chemical substances now known as vitamins. About 1 per cent of the energy radiated by the sun came in the form of these rays, but, in passing through the atmosphere, a considerable proportion of them were absorbed, so that at sea level the supply was scantier than on mountain tops. The less pure atmosphere of cities absorbed a still further proportion so that there was the more need to make use of what were left. Ordinary window glass transmitted heat and visible light, but was quite untransparent to the health-giving ultraviolet rays. Mr. Lamplough, after prolonged experiment, had invented a form of glass which was transparent to ultraviolet rays. He hoped that before long it would be used extensively, not only in institutions, but also in private houses. The Zoological Society has built a special house to test it, and, as a result of its success there, had installed it in the lion house and in parts of the existing reptile house. They are also placing it in the new reptile house and in the monkey house. It has been found that ultraviolet rays have a markedly beneficial influence on the vitality and spirits of reptiles, monkeys, and the large carnivores. In foggy weather, almost no ultraviolet rays penetrates the atmosphere, and to provide for such occasions, too frequent in London in the winter, the zoo has installed a powerful electric light of different kinds, in bulbs transparent to ultraviolet rays, so as to give artificial sunlight. Delicate monkeys that formerly moped all winter were seen basking in the light rays and dashing in and out of their cages, which communicated with open-air dens, in the best of health and spirits. The visitors also saw delicate reptiles that formerly never ate and seldom survived the winter eating vegetable food with relish.—London letter, *J.A.M.A.*, Dec. 11, 1926.

Plan Use of Motion Pictures in Medical Instruction: It is reported that steps will soon be taken to begin experimentation with the motion picture film in the teaching of medicine and surgery. At a recent conference in Rochester, N. Y., leading surgeons met with technical experts to discuss the feasibility of employing the motion picture in recording the progress of disease and the functioning of the human body.

Hotel Hospital: One of the recently completed hostelries in Chicago has a suite of eleven rooms equipped to give hospital care to the ill or injured guests or employes. A physician with a corps of assistants is always in attendance, and while it is aimed to make this hospital a clearing house for the more serious cases that arise, there is every facility for caring for the emergency case that may call for immediate operation.

United States to Fight Fake Cure-Alls and Beauty-Aids: The federal trade commission has determined to wage war on the fake advertisements of antifat remedies, patent medicines for incurable diseases, and fake beauty aids. It is estimated that these advertisers obtain more than $500,000,000 annually from the public, a greater part of this sum coming from the poorer classes.

Army Dental Corps

Orders to Maj. T. C. Daniels so as to direct him to proceed to Baltimore, Md., for duty at Army dispensary, Baltimore, and additional duty with medical department, 3d C. A. headquarters.—Army & Navy Register, Dec. 11, 1926.

Lieut. Col. R. E. Ingalls relieved treatment Walter Reed General Hospital, return to station at Chicago. He is granted 5 days' leave.

Capts. C. R. Hollister and G. R. Kennebeck relieved duty dental school and temporary duty medical field service school, effective upon completion of course about May 28, assigned as follows: Capt. Hollister to Fort Bragg, and Capt. Kennebeck to Fort Hayes.

Capt. B. M. Epes and W. C. Caldwell relieved dental school and temporary duty at medical field service school upon completion of course about May 28, ordered Walter Reed General Hospital for duty.

Following officers relieved duty dental school and temporary duty at medical field service school upon completion of course about May 28, ordered to Walter Reed General Hospital for duty: 1st Lieuts. M. E. Kennebeck, H. D. Phillips, F. E. Patterson and A. L. Irons.—Army & Navy Register, Dec. 25, 1926.

Navy Dental Corps

Officers of the Navy dental corps are to change station and duties as follows: Lieut. Comdr. Richard C. Green from naval hospital, Pearl Harbor, Hawaii, to U. S. S. Procyon; Lieut. Comdr. Guy E. Nicholas from naval station, Tutuila, Samoa, to receiving ship at San Francisco; Lieut. Comdr. Errol W. Willett from Marine Corps base, San Diego, Calif., to temporary duty with western mail guard; Lieut. William T. Davidson from naval training station, Great Lakes, Ill., to Philadelphia, navy yard; Lieut. Joseph A. Kelly from U. S. S. Dobbin to naval training station, Newport, R. I.; Lieut. Francis J. Long from U. S. S. Arizona to navy yard, Mare Island, Calif., and Lieut. John J. Haas from receiving ship at San Francisco to naval hospital, San Diego.

Upon completion of temporary duty in attendance upon course of instruction at naval medical school at Washington, December 23, the following officers of Navy dental corps will be assigned to duty as follows: Lieut. Carlton B. Morse to U. S. S. Richmond; Lieut. William D. Day to U. S. S. Dobbin; Lieut. William R. Burns to Naval Academy, and Lieut. Daniel W. Ryan to Norfolk navy yard.—Army & Navy Register, Dec. 4, 1926.

Deaths

Boecher, Hugo, Milwaukee, Wis.; died, December 1, of heart failure, while out hunting; aged 54.

Booth, Charles E., Superior, Wis.; State University of Iowa, College of Dentistry, 1890; died, December 22; aged 60.

Brookes, Samuel Owen, Charlotte, N. C.; University of Maryland School of Dentistry and the Baltimore College of Dental Surgery, 1896; died, October 4, of pneumonia, aged 52.

Chapman, Leslie G., Hartford, Conn.; died, December 3, after a short illness; aged 74. Dr. Chapman practiced dentistry in Hartford for more than 45 years. Dr. Leslie G. Chapman, Jr., is one of the surviving children.

Crane, Edwin A., Chicago and Libertyville, Ill.; Northwestern University Dental School, 1903; died, December 15; aged 46. Dr. Crane had been in ill health for some time but had continued in practice.

Galvin, T. R., Dillonvale, Ohio; Ohio College of Dental Surgery, 1915; died, December 5, after a brief illness with pneumonia.

Hermann, J. L., Hopkins, Minn.; Marquette University, School of Dentistry, 1910; died suddenly, of heart disease, September 29; aged 30.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Division of Sensory Root on Both Sides in Trigeminal Neuralgia: A case of division of the sensory root on both sides, in the first of a series of 432 radical operations for major trigeminal neuralgia, is reported by C. H. Frazier (*J.A.M.A.*, Nov. 20, 1926). A woman, aged 51, had had a major operation for trigeminal neuralgia nine years earlier, with avulsion of the left sensory root under ether. No attempt was made to conserve the motor root. When the patient was examined on her second admission, the electrical reaction of the muscles of mastication on the side of operation were those of complete degeneration. The symptoms of major neuralgia were now confined to the maxillary division of the right side. Although as a matter of routine the author had conserved the motor root in all operations since 1919, he approached this particular operation with trepidation because of the paralysis of the left side, fearing that there might ensue an accidental injury to the motor root on the right side. Alcohol injection was suggested, but was refused. The operation was undertaken only after the patient has signed a statement relieving the surgeon of responsibility in case of any ill consequences. A subtotal section of the right sensory root was performed, with the usual approach. Considerable time was spent in exposing the superior surface of the ganglion, and for awhile there was free oozing. Satisfactory exposure of the ganglion and root was obtained, and the outer two-thirds of the sensory root, which seemed very small, was sectioned, the motor root being undisturbed. The wound was closed without drainage. Immediately after the operation, the patient could not approximate the jaws, but on the seventh day she began to recover function, and, on her discharge from the hospital, she could approximate the jaws and masticate food.

Surgical Diathermy in Accessible Neoplasms: According to Kobak (*Illinois M. J.*, November, 1926), experience has demonstrated the superiority of surgical diathermy over the knife in the treatment of accessible neoplasms. Coagulation and desiccation are the only visible changes in the cellular structure. Coagulation is evidenced by the gradual transformation of the tissue in the vicinity of the active electrode into a grayish substance, followed quickly by a bubbling about the electrode and escape of a vapor-like gas. The treated tissue becomes of a cheesy consistency and can be easily scraped away with a dull curet. If coagulation continues beyond this point, stellate sparkling is seen about the point or disc electrode, the underlying or adjacent tissue becomes hard and carbonization follows. In desiccation, the heat is less and hence destruction of tissue more superficial, being accomplished by the process of dehydration. Small growths of the basal cell type yield readily to desiccation and the cosmetic results are good. In more advanced malignancy, coagulation offers the best results. Walling off the neoplasm is advised where possible. The disadvantages of the knife are: danger of implantation of viable cells, danger of hemorrhage, and the possible transmission through the circulation of cancer cells into distal parts. Advantages of diathermy are: destruction of the entire growth *in situ*; ability to transmit the heat to a depth in the tissue beyond that actually treated, thus assuring the destruction of any malignant cells which have been lying beyond the area which actually appears to have been involved; practical elimination of either primary or secondary hemorrhage, as the blood vessels are thrombosed beyond the area of destruction; less risk of metastasis; minimum formation of connective tissue, assuring little scarring; alleviation of pain; lack of shock; accuracy of dosage, and sterilization of the wound incidental to treatment. Familiarity with technic is essential, but exact

diagnosis and proper establishment of therapeutic indications make diathermy reliable and effective.

Some Physical Factors in the Administration of Gaseous Anesthetics: According to E. I. McKesson (*Cur. Res. Anes. & Anal.*, December, 1926), modern anesthesia is a mechanical application of many of the laws of physiology, physics and chemistry, and an appreciation of the purposes and mechanism of administration comprises about half of the science of anesthetics, while much of the art may be credited to the apparatus with which to meet the problems in technic and to accomplish these purposes. The physical factors in the administration of gaseous anesthetics have been discovered and appliances have been devised for their successful application, the most important of these factors being: 1. Suitable inhalers for excluding air. 2. Regulation of the mixture of gases with means of maintaining any desired mixture. 3. The direct control and maintenance of pressure above that of the atmosphere, when required, without exceeding the safe pressure desired and also without unnecessary waste of gases. 4. Means of measuring the tidal respiration, and estimating the patient's ventilation to determine the need for rebreathing. Also means for rebreathing any desired measured volume of each exhalation. 5. Means for performing artificial respiration with oxygen by inflation as an integral part of the apparatus. The intermittent flow principle coordinates well the above mentioned essentials for an anesthetizing apparatus.

Perforation of Third Lower Molar by Mandibular Nerve: In this case, reported by E. A. S. Hoare (*Brit. Dent. J.*, Oct. 15, 1926), the patient, a young woman, had been suffering for some time with neuralgia pains in the ear and neck. The teeth on the affected side were sound, but the lower third molar had not fully erupted. It was not impacted. Extraction was made under nitrous oxid anesthesia, without difficulty, but the patient, on recovery from anesthesia, showed symptoms of severe shock. Hemorrhage was normal. Examination of the tooth revealed a hole between the roots, through which the contents of the mandibular canal had passed. There was loss of sensation over the area supplied by the nerve and the lower teeth on that side did not respond to heat; a condition that obtains after more than a year. The wound healed quickly and the pain disappeared, although tingling and pricking sensations continued for some time over the numbed area. It is doubted that a radiogram would have shown the relation of the nerve to the tooth.

Necrosis of Jaws: A case of necrosis of the jaws in a child, in which the permanent dentition was not destroyed, is reported by J. A. Burgoa. (*Dent. Mag.*, December, 1926.) A native girl, aged 12, had partial contraction of the mandible and foul and penetrating breath. The muscles of the cheek seemed to be attached to the gum and gingival border by long cicatrices, and the child could scarcely talk or swallow food. The area of necrosis extended in the upper jaw from the temporary cuspid to the temporary second molar, involving the whole of the alveoli, and forming a single mass in which a group of temporary teeth could be seen embedded. In the lower jaw on the same side, the necrosis extended over a similar area. The cause of the condition could not be determined. The child was not tuberculous or syphilitic. She had not had typhoid fever, and she had met with no accidents. The beginning of the trouble may have dated from a period of twenty-four hours in which, at the age of 10, she was lost and suffered from cold and exposure. A suppurating form of pharyngitis, neglected, may have developed into acute osteitis and then necrosis. Operation proved difficult as the mouth could be opened only a little way. When the sequestrum was removed, a group of teeth belonging to the permanent dentition were disclosed. Three weeks after operation, suppuration had ceased and all discomfort had disappeared, and the patient was shortly completely restored to health. As the sequestrum was removed via the mouth, and the permanent dentition is intact, it is believed that there will be no disfigurement.

Dental Defects Cause School Absenteeism: A recent report by the secretary of the Virginia State Board of Education points out that 383,936 children inspected by the teachers in the public schools of Virginia last year, 203,130 had defective teeth and 40 per cent of school absences are due to dental disorders. This represents over thirty-five and a half million school days.—*Nation's Health*, December, 1926.

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, October 24-28, 1927, Detroit, Michigan.

American Society of Orthodontists, May 3-6, 1927, Chicago, Illinois.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

February (1927)

Minnesota, at St. Paul (23-25).

March (1927)

Louisiana, at New Orleans.
Montana, at Billings (24-26).
Pennsylvania, at Scranton (8-9). (Mid-winter.)

April (1927)

Alabama, at Montgomery (12-14).
Connecticut, at New London (28-30).
Kansas, at Topeka (20-22).
Kentucky, at Louisville (5-7).
New Jersey, at Newark (27-30).
North Carolina, at Greensboro (11-13).
Oklahoma, at Oklahoma City (25-28).

May (1927)

Arkansas, at Hot Springs (9).
Illinois, at Peoria (10-12).
Indiana, at Indianapolis (16-19).
Iowa, at Des Moines (3-5).
Maryland, at Baltimore (2-4).
Massachusetts, at Boston (2-6).
Missouri, at St. Louis (23-26).
Nebraska, at Omaha (16-19).
New York, at Buffalo (18-20).
Pennsylvania, at Pittsburgh (10-13).
South Carolina, at Columbia (9-11).
South Dakota, at Sioux Falls (9-11).
Tennessee, at Memphis.
Texas, at Austin (10-13).
Vermont, at Burlington (25-27).
Virginia, at Virginia Beach (9-11).
West Virginia, at Martinsburg (16-18).

June (1927)

Colorado, at Colorado Springs (15-18).
Georgia, at Albany.
Maine, at Belgrade Lakes (21-23).
New Mexico, at Roswell.
Wyoming, at Thermopolis.

July (1927)

Porto Rico, at San Juan.
Wisconsin, at Milwaukee (12-14).

October (1927)

Florida, at St. Petersburg.

December (1927)

Ohio, at Cleveland (2-4).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

West Virginia, at Charleston, June 28, 1927. Secretary, C. H. Neill, 206 Professional Building, Fairmont, West Virginia.

CONNECTICUT STATE DENTAL ASSOCIATION

The sixty-third annual meeting of the Connecticut State Dental Association will be held, April 28-30, 1927, at New London.

J. M. SHAY, *Chairman*,
Publicity Committee,
49 Main Street,
New London, Conn.

MAINE DENTAL SOCIETY
(A correction)

The annual meeting of the Maine Dental Society will be held at The Belgrade, Belgrade Lakes, instead of in Rockland, as previously announced. The date is June 21-23, 1927.

W. F. FOGG, *Secretary*,
Waterville, Me.

MISSOURI STATE DENTAL ASSOCIATION

The next meeting of the Missouri State Dental Association will be held at the Chase Hotel, St. Louis, May 23-26, 1927. E. H. Keys is chairman of the program committee and G. W. Winter, president of the association.

O. W. BRANDHORST, *Chairman*,
Publicity Committee,
4500 Olive St., St. Louis, Mo.

PENNSYLVANIA STATE DENTAL SOCIETY

The annual meeting of the Pennsylvania State Dental Society will be held at Syria Mosque, Pittsburgh, May 10-13. The program is outlined for the particular benefit of the general practitioner. The first day will be devoted to the dental problems of childhood and dental pathology. The second day will be an operative dentistry day, covering all phases of dentistry strictly classified as operative. The third day will be devoted to all forms of prosthetic restoration and clinics on oral surgery. The fourth day of the meeting, the oral surgery clinics will be continued, and all phases of operative and prosthetic restoration will be shown in clinics and special lecture clinics by competent men. All ethical members of the dental profession are invited to attend.

Further notices and a completed program will be published in this magazine at a later date. Leslie Waddill, 7124 Jenkins Arcade Bldg., Pittsburgh, is in charge of exhibits; H. C. Metz, 1202 Highland Bldg., Pittsburgh, in charge of local arrangements. Hotel reservations should be made early through Dr. Metz.

A. C. BARCLAY, *Secretary*,
Highland Building,
Pittsburgh, Pa.

MIDWINTER MEETING OF PENNSYLVANIA STATE DENTAL SOCIETY

The first annual midwinter meeting of the Pennsylvania State Dental Society will be held at Scranton, March 8-9. The Eastern Zone will act as host to the Pennsylvania State Dental Society, and the meeting will be under the direction of the Susquehanna Dental Society. All component societies throughout the state will receive notification and full details regarding the plan to hold these midwinter meetings annually, which was ratified by the Council.

EDMOND J. DONNEGAN, *Chairman*,
Local Arrangements,
Brooks Bldg., Scranton, Pa.

VIRGINIA-CAROLINA CLINIC

The Virginia-Carolina Clinic will hold its third annual course in the buildings of the Medical College of Virginia, at Richmond, Monday-Wednesday, Feb. 14-16, 1927. Instruction will be given in oral surgery and anesthesia by J. R. Cameron, Philadelphia, Pa.; pedodontia by Thomas B. McCrum, Kansas City, Mo.; bridgework, by T. W. Maves, Cleveland, Ohio, and amalgam restorations by the Harvard Amalgam Club, Boston, Mass. Communications regarding the clinic may be addressed to

J. R. MCCAULEY,
12th and Clay Sts.,
Richmond, Va.

SIXTH AUSTRALIAN DENTAL CONGRESS

The Sixth Australian Dental Congress will be held in the new Anatomy School of the University of Melbourne, Aug. 22-27, 1927. The congress will be divided into sections, covering the various phases of dentistry. Discussions will embrace the full range of dental practice, and an extensive program of clinics will be staged. A trade exhibition will be a feature of the meeting. Visiting dentists from beyond Australia will receive a cordial welcome and may count on an interesting sojourn in a city noted for its healthfulness, recreational facilities and civic progress.

W. J. TUCKFIELD, *President*,
R. J. B. YULE, *Honorary Treasurer*,
GEORGE FINLEY, *Honorary Secretary*.

VIRGINIA STATE DENTAL ASSOCIATION

The next annual meeting of the Virginia State Dental Association will be held at the Hotel Cavalier, Virginia Beach, Va., May 9-11, 1927.

A. M. WASH, *Secretary*,
Medical College of Virginia,
Richmond, Va.

MASSACHUSETTS DENTAL HYGIENISTS' ASSOCIATION

The Massachusetts Dental Hygienists' Association will hold its convention at the Hotel Statler, Boston, May 2-6, 1927.

M. ELLA LEBLANC,
178 Marlborough St.,
Boston, Mass.

SOUTH CENTRAL DENTAL SOCIETY MEETING (Indiana)

The South Central Dental Society meeting will be held at the Grey Stone Hotel, Bedford, Ind., Wednesday, March 2, 1927.

JOHN G. HOGAN, *President*,
Citizens Trust Bldg.,
Bedford, Ind.
B. S. SHINNESS, *Sec'y-Treas.*,
Seymour, Ind.

ALUMNI ASSOCIATION, COLLEGE OF DENTISTRY, UNIVERSITY OF SOUTHERN CALIFORNIA

The nineteenth annual meeting of the Alumni Association, College of Dentistry, University of Southern California, will be held at the College of Dentistry, 16th and Los Angeles Sts., Los Angeles, Jan. 31-Feb. 2, 1927. It is the aim of the alumni association, in conducting these annual meetings, to prepare an intensive course of clinics and papers of particular interest to the general practitioner. The clinic demonstrations and addresses cover every department of science and art. All ethical dentists are welcome and are urged to attend.

The ballroom of the Elks' Club has been secured for the annual "Hi-Jinks," which will be held Tuesday evening, February 1.

VERN J. SMITH, *Secretary*,
1304 Medico-Dental Bldg.,
Los Angeles, Calif.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the West Virginia State Board of Dental Examiners, for license to practice dentistry or to practice oral hygiene will be held at Charleston, June 28, 1927. For further information and application forms, address

C. H. NEILL, *Secretary*,
206 Professional Bldg.,
Fairmont, W. Va.

BOOK REVIEW

Principles of Exodontia, As Applied to the Impacted Mandibular Third Molar. A Complete Treatise on the Operative Technic with Clinical Diagnoses and Radiographic Interpretations. By George B. Winter, D.D.S., F.A.C.D. Author of "Exodontia;" Professor of Exodontia at Washington University School of Dentistry; Former Teacher of Exodontia at Extension Course of Columbia University, New York; Associate Member of the Section of Maxillo-Facial Surgery in United States Government School, organized during the war. With 834 illustrations—drawings by Tom Jones. 835 pages. Published by American Medical Book Company, St. Louis, Mo.

The marvelous development in the science of exodontia, particularly in the management of complicated cases, is demonstrated by this classic presentation of Dr. Winter. When a book of 835 pages, with as many illustrations, is devoted to the one topic of the impacted mandibular third molar, the importance of the subject, as well as the comprehensive manner in which it is treated, must be apparent. It is doubtful that any single phase of dental practice has ever been covered with the thoroughness Dr. Winter has displayed in the treatment of this subject. The author has long been known as a masterly operator in difficult cases of impacted third molars, and in this book he has recorded every possible feature of his long and successful experience. The publishers and illustrators have done their work in a most satisfactory manner and the volume as a whole is a most worthy addition to our literature.

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By Ernest V. Madison

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